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A REVISION OF THE SOUTH AMERICAN CHARACID FISHES OF THE GENUS *CARNEGIELLA*

By Agustin Fernandez-Yepez

The material upon which this paper is based came to light during my work on South American fresh-water fish collections, for which research I have been in this country, under the auspices of the Ministry of Agriculture, Venezuelan Government, from May, 1946, to August, 1947. I wish especially to thank the following persons for their aid during the preparation of this revision: Dr. George S. Myers, for making available to me the Stanford Natural History Museum collections and library, and for helping me with his vast knowledge of systematics; Dr. Robert C. Miller, for permitting me to use the collections of the California Academy of Sciences; Dr. Luis R. Rivas and Miss Margaret Storey for helping me during preparation of this paper at Stanford; and Dr. William C. Schroeder, for his great kindness in loaning me some of the specimens upon which Garman based his description of *Gasteropelecus fasciatus*. The work was done in the Stanford Natural History Museum.

Genus *CARNEGIELLA* Eigenmann

Carnegiella Eigenmann 1909, p. 13 (genotype by original designation, *Gasteropelecus strigatus* Günther).

This genus of Characidae is characterized by a deep and strongly compressed body, keeled ventrally. It differs from the other genera of the subfamily Gasteropelecinae in the absence of the adipose fin. "Maxillary with a single tooth" has no value as a generic character, because I have found one or two such teeth in *C. marthae* and four or five in *C. myersi*. The premaxillary and mandibular teeth are tricuspid, and vary in number from 7 to 20 on each mandible, and from 7 to 11 on each premaxillary bone.

This genus is recorded only from northern South America east of the Andes. The fishes are small, the largest being under four centimeters in standard length. They inhabit the lower and clear waters of creeks tributary to the Amazonas, Orinoco and Essequibo rivers. In the Orinoco basin this genus is represented by *C. marthae*, reported only from near Caicara,

FREQUENCY DISTRIBUTION OF ANAL RAYS IN CARNEGIELLA

Species	Localities	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
C. marthae	Laguna San Rafael	1														
	Caño de Quiribana	2	3	1												
	Opposite Pan de Azucar	1	1	1												
C. schereri	Pebas								1							
	Lagoa Hyanuary						2									
C. strigata	Gluck Island						1	3	2							
	Tumatumari					1	1	2								
	Potaro Landing					2	4	2	1							
	Cudajás							2								
C. fasciata	Near Itaya							1	3	4	4					
	Tabatinga											1				
	Lagoa Saraca								2		1					
C. myersi	Yurimaguas												2	3	5	1

FREQUENCY DISTRIBUTION OF DORSAL RAYS IN CARNEGIELLA

Species	Localities	8	9	10
C. marthae	Venezuela			10
C. schereri	Peru and Brazil			3
C. strigata	Br. Guiana and Brazil			21
C. fasciata	Peru and Brazil		5	11
C. myersi	Peru	2	8	

below the mouth of the Apure river The late Dr. Carl Ternetz, collecting in the upper Orinoco and Casiquiare in 1924-25, found no specimens of *Carnegiella* between the mouth of the Apure river and the junction of the Casiquiare with the Rio Negro. The upper Amazonian representatives of the genus are *C. myersi, C. fasciata,* and *C. schereri;* the first was found near Yurimaguas, Peru; the second in the area extending from the Pebas district of Peru, near Iquitos, to Tabatinga, Brazil; and the third in "Caño Shansho",[1] in the Pebas district of Peru and in Lagoa Hyanuary, Brazil, in the lower Amazon. *Carnegiella strigata* is reported from the rivers of British Guiana, and from the lower Amazon upstream to "Barreira do Cudajás" (near Manaos); further material may reveal subspecific differences over this range. There are no records for this genus in the western Andes, in the drainages of the northward flowing Colombian and Venezuelan rivers, nor in the Maracaibo and Valencia basins of Venezuela. Records of aquarists are not included here, because too many uncertainties surround the collecting data. These fishes, however, are well known to the aquarists who call them "hatchet fishes", and their habits have been recorded in aquarium literature.

In 1864, Günther described *C. strigata,* which he placed in the genus *Gasteropelecus.* Garman, in 1890, described *C. fasciata,* also as a species of *Gasteropelecus.* The genus *Carnegiella* (named for Miss Margaret Carnegie, daughter of Andrew Carnegie) was erected by Eigenmann in 1909, based on *G. strigatus,* with *G. fasciatus* in the synonymy. In 1927, Myers described *C. marthae.* Since that time, with the exception of new locality records, no systematic changes have been made. Now, after a study of material in the collections of the California Academy of Sciences, the Stanford Natural History Museum, and the Harvard Museum of Comparative Zoology, the number of recognized species is increased from two to five.

For the present study measurements were made with sharp pointed dividers and a Paragon half millimeter rule; all measurements and counts were taken under the binocular microscope. The dentition was studied directly and from clay impressions. Proportions are recorded as permillage, that is, in thousandths of the standard length, unless otherwise indicated.

Standard length was measured from tip of snout to middle caudal base; depth is the greatest body depth, taken at the midpoint between tip of snout and origin of dorsal fin; length of head is from tip of snout to rearmost point of the operculum; depth of head was measured through center of eye; interorbital space is the distance between the bony orbital rims; upper caudal peduncle length is the distance between the base of the last dorsal ray and the midcaudal base.

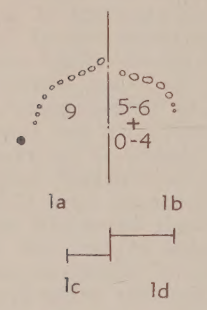
To avoid confusion, the fishes are figured without scales or fin rays, and only the principal and characteristic parts of the bones, body, and fins are shown. In the drawings of the tooth patterns, the conical ("canine") maxillary teeth are represented as solid black spots, to differentiate them from the tricuspid premaxillary and mandibular teeth, shown as open circles.

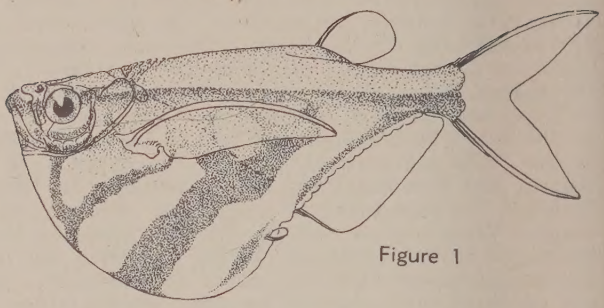
The last (divided) anal and dorsal rays were counted as two. In all the species only the first two rays of the anal and dorsal are undivided. No distinction in type of ray was made in recording the counts. The dorsal rays vary in number from 8 to 10 as follows: *C. myersi,* 8 or 9; *C. fasciata,* 9 or 10; *C. marthae, C. schereri,* and *C. strigata,* 10. The anal ray counts vary from 22 to 36: *C. marthae,* 22 to 24; *C. schereri* and *C. strigata,* 26 to 29; *C. fasciata,* 28 to 32; and *C. myersi,* 33 to 36.

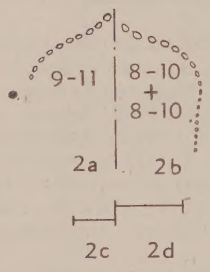
The body depth is contained less than twice in the standard length in *C. fasciata, C. marthae,* and *C. schereri;* while in *C. myersi* and *C. strigata* it is twice or more.

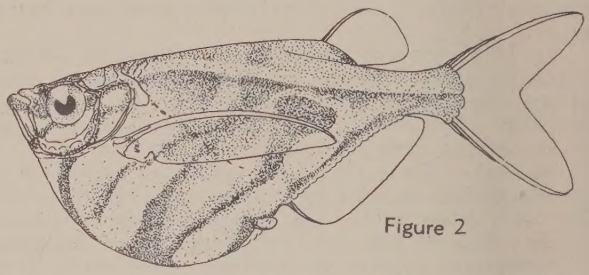
The colors and markings of the species are characteristic and fairly con-

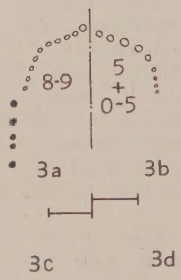
[1] This seems to be a misspelling of "Chancho" (pig).











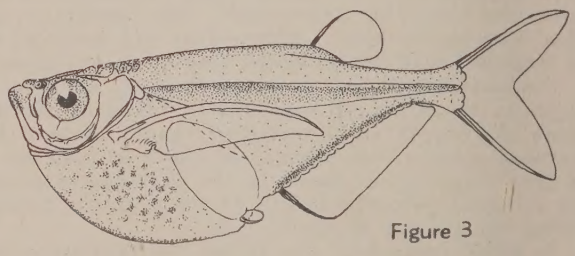
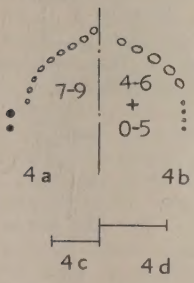


FIG. 1. *Carnegiella fasciata* (Garman). 1a. Maxillary (solid circle) and pre-maxillary (open circles) tooth pattern, with number (9) of pre-maxillary teeth. 1b. Mandibular tooth pattern, with numbers of large anterior teeth + number of small posterior teeth (5-6 + 0-4). 1c. Eye diameter, compared to (1d) interorbital width. FIG. 2. *Carnegiella strigata* (Günther). 2a. Maxillary (solid circle) and premaxillary (open circles) tooth pattern, with numbers of large anterior teeth + numbers of small posterior teeth (8-10 + 8-10). 2c. Eye diameter, compared to (2d) interorbital width. FIG. 3. *Carnegiella myersi* Fernandez-Yepez. 3a. Maxillary (solid circles) and premaxillary (open circles) tooth pattern, with number (8-9) of pre-maxillary teeth. 3b. Mandibular tooth pattern, with numbers of large anterior teeth + number of small posterior teeth (5 + 0-5). 3c. Eye diameter, compared to (3d) interorbital width.



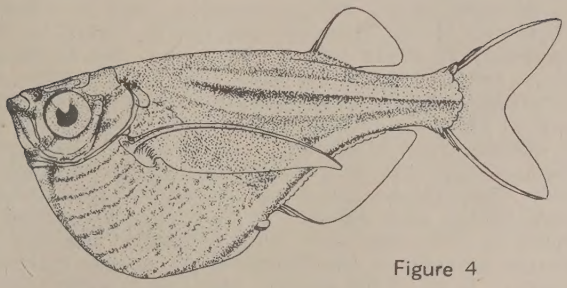
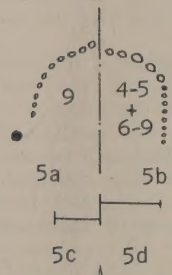


Figure 4



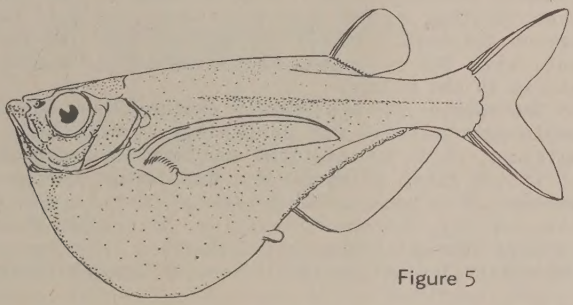


Figure 5

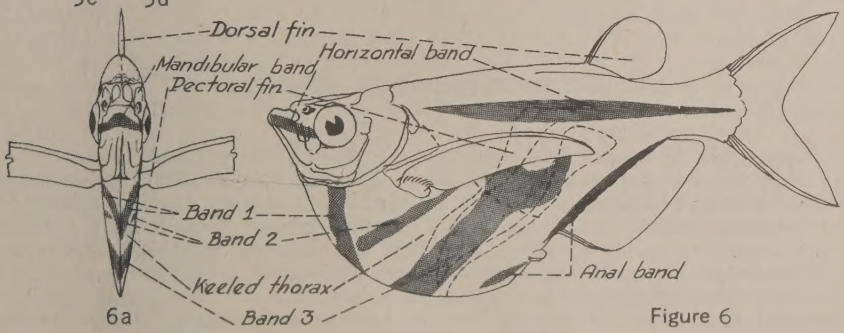


Figure 6

FIG. 4. *Carnegiella marthae* Myers. 4a. Maxillary (solid circles) and pre-maxillary (open circles) tooth pattern, with number (7-9) of premaxillary teeth. 4b. Mandibular tooth pattern, with numbers of large anterior teeth + number of small posterior teeth (4-6 + 0-5). 4c. Eye diameter, compared to (4d) interorbital width. FIG. 5. *Carnegiella schereri* Fernandez-Yepez. 5a. Maxillary (solid circle) and premaxillary (open circles) tooth pattern, with number (9) of premaxillary teeth. 5b. Mandibular tooth pattern, with numbers of large anterior teeth + number of small posterior teeth (4-5 + 6-9). 5c. Eye diameter, compared to (5d) interorbital width. FIG. 6. Composite diagrams of a *Carnegiella*, to show denominations of color markings used in the descriptions.

stant within each species. The principal diagonal body bands, entirely lacking only in *C. myersi*, are shown and numbered in Fig. 6. Band number 1 is present in all but *C. myersi*. Band 2 appears in *C. fasciata* and *C. strigata;* on the first it is strongly joined to band 1, forming a Y; on the second it is often less distinct, and may or may not meet band 1, to which it is never strongly joined. Band 3 is present on both *C. fasciata* and *C. strigata*, appearing as a simple band on the former, but on the latter it is partly divided, forming a V. Bands 2 and 3 are absent in *C. schereri* and *C. marthae* (and of course in *C. myersi*). *Carnegiella marthae* has, in addition, concentrations of chromatophores on the thorax forming a group of more than five narrow lines curved backward and upward from the keel, and paralleling each other. In *C. myersi* the chromatophores form a group of spots in this same area, each no larger than the pupil. The few chromatophores present on the thorax of *C. schereri* form neither bands, lines nor spots. In all five species there is a very narrow horizontal band or bar running backward from the upper angle of the operculum to the midcaudal base, another narrow band runs along the anal base, and a few such bands are on the head. In all the species the fins are colorless and transparent, with the exception of the pectoral, which sometimes has chromatophores in the middle.

The species are most easily distinguished by the differences in the body depth and the anal and dorsal ray counts, and, most strikingly, by the markings, which are distinct and fairly constant for each species.

In the lists of specimens, CAS refers to the Museum of the California Academy of Sciences, San Francisco, Calif.; MCZ to the Museum of Comparative Zoology, Harvard University, Cambridge, Mass.; and SU to the Natural History Museum of Stanford University, Stanford, Calif. The old Indiana University collection (IU) is now in the California Academy of Sciences.

KEY TO THE SPECIES OF *CARNEGIELLA*

1a. Anal rays 33 to 36, usually 34 or 35; four or five teeth on each maxillary; caudal peduncle very slender, its least depth 72 to 95 thousandths of standard length; a large, oval, oblique, silvery area extending from behind pectoral base to pelvic fin; band number 1 (forming a V beneath isthmus in other species, see Fig. 6a) absent; a broad silvery band from head to caudal base; no oblique, curved or irregular band or lines on thorax (Peruvian Amazon).....*C. myersi*, sp. n.

1b. Anal rays 22 to 32; one or two teeth on each maxillary; caudal peduncle deeper, its least depth 89 to 123 thousands of standard length; no large, oval, silvery area from behind pectoral base to pelvic fin; band number 1 always present, forming a V beneath isthmus when fish is viewed from front (Fig. 6a); a lateral band usually present, but dark, not wide and silvery; oblique or upcurving bands from edge of thorax usually present (absent only in *C. schereri*).

2a. Thorax with a narrow, almost continuous dark band on the edge; no wide, irregular, wavy bands on thorax; thorax speckled with chromatophores or with narrow, parallel, upcurved, dark lines.

3a. Anal rays 22 to 24, usually 22 or 23; thorax with five or more narrow lines (Rio Orinoco).....*C. marthae* Myers

3b. Anal rays 27 to 29; thorax without lines, speckled with chromatophores (Peruvian Amazon).....*C. schereri*, sp. n.

2b. Thorax without narrow, continuous band on the edge, but with wide, irregular, oblique, wavy dark bands.

4a. Body more slender, depth contained twice or more in standard length; anal rays 26 to 29, usually 27 or 28; band number 3 always divided almost to edge of thorax by a paler area; bands 1 and 2 seldom forming a complete Y anteroventrad of pectoral base; dorsal rays 10 (Guiana and Amazon to above Manaos).....*C. strigata* (Günther)

4b. Body deeper, depth contained less than twice in standard length; anal rays 28 to 32, usually 29 or more; band number 3 entire until on a level with pectoral base, where a light spot the size of the eye or larger is enclosed within the broadened upper part; bands 1 and 2 always forming a complete Y anteroventrad of pectoral base; dorsal rays 9 or 10, usually 10 (Upper Rio Solimoes and Rio Maranon).....
.....*C. fasciata* (Garman)

Carnegiella myersi Fernandez-Yepez, new species
Figs. 3, 3a, 3b, 3c, 3d.

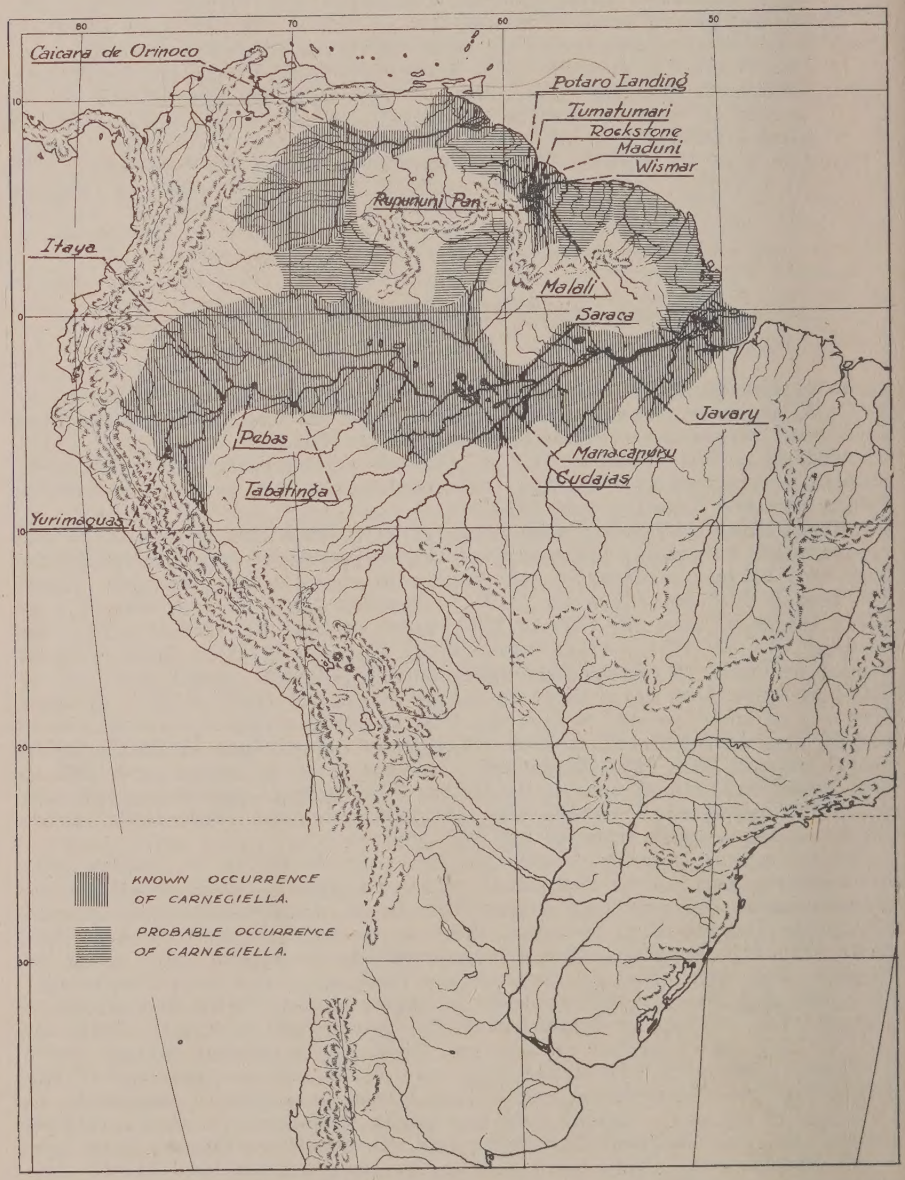
Holotype: SU 16120, a mature female, with eggs, 20 mm., collected by W. R. Allen in a creek near Yurimaguas, Peru, in Nov., 1920, during the Centennial Expedition of Indiana University to Peru.

Paratypes: Ten specimens 19.5 to 22.0 mm.: 5 CAS 20081 and 5 SU 16053, mature, mostly females with eggs, collected at the same place by W. R. Allen during the same Expedition in 1920.

Counts and measurements were taken of all eleven specimens and are recorded below with proportions in permillage of standard length first for the type and, between parentheses, the variations found in the paratypes. Standard length 20.0 mm. (19.5 to 22.0). Greatest depth of body 450 (432 to 478); length of head 275 (250 to 282); depth of head 185 (168 to 190); diameter of eye 100 (95 to 112); interorbital 103 (108 to 135); least depth of caudal peduncle 95 (72 to 92); upper caudal peduncle length 265 (226 to 260); distance from tip of snout to dorsal origin 685 (640 to 731); distance from tip of snout to anal origin 625 (625 to 658); origin of pectoral fin to end of anal base 690 (690 to 758); length of dorsal base 90 (88 to 109); length of anal base 405 (362 to 406); maximum depth of opercle 168 (160 to 178); maximum width of opercle 90 (68 to 103); longest dorsal ray 150 (128 to 150); longest anal ray 150 (114 to 138); upper and lower caudal lobes subequal, the longest branched ray 335 (330 to ?).

Dorsal rays 9 (8 or 9, usually 9); anal rays 34 (33 to 36, usually 35); the number of scales was impossible to take accurately because of the absence of some. Eight or nine premaxillary teeth, first tooth of the premaxillary the largest (Fig. 3a), the others decreasing in size backward. Mandible with five larger teeth and 0 to 5 smaller teeth, the third tooth the largest (Fig. 3b). Four or five canine or conical teeth on the maxillary. Mandible projecting. Greatest depth of the body little more than length of pectoral fin. Origin of dorsal fin ± 2/3 from the tip of snout. Maxillary shorter than the diameter of eye, not reaching horizontal through lower margin of the orbit. Predorsal contour a little convex from base of the dorsal fin forward; from the end of dorsal base to origin of caudal rays it is slightly concave. Caudal peduncle longer than deep. Distance between origin of pelvic and anal fins about equal to diameter of eye. First pectoral ray longest, about two times in the standard length. Pelvic fins small, less than 3/4 diameter of eye. Fourth dorsal ray longest. Fifth anal ray longest.

Coloration (in alcohol) yellow with silvery band along midaxis of body, from angle of opercle to midcaudal base, and a silvery oval area between


Caicara de Orinoco
Potaro Landing
Tumatumari
Rockstone
Maduni
Wismar
Rupununi R.
Itaya
Malali
Saraca
Javary
Pebas
Manacapuru
Tabatinga
Gudajas
Yurimaguas
KNOWN OCCURRENCE OF CARNEGIELLA.
PROBABLE OCCURRENCE OF CARNEGIELLA.

pelvics and posterior part of the pectoral fins, its depth 3.5 to 4.0 times in standard length, and its width 3.0 to 3.5 times in depth of body. A dark lateral band over the silvery one, narrower and darkish in the upper border. The thorax without bands but with dark spots about the size of the pupil. A band along the anal base (Fig. 3). Fins are plain with the exception of the pectorals, which sometimes have a few chromatophores.

This new species differs from *C. strigata, C. fasciata,* and *C. marthae* in lacking any kind of bands on the thoracic region; from all *Carnegiella* in having more anal rays, more maxillary teeth, and other characters shown in the key and tables.

Named *myersi* in honor of Professor George S. Myers, who has made extensive contributions to the knowledge of South American fish fauna.

Carnegiella marthae Myers
Figs. 4, 4a, 4b, 4c, 4d.

Carnegiella marthae Myers, 1927, p. 119 (Caño de Quiribana, near Caicara de Orinoco; opposite Pan de Azucar; creek into Laguna San Rafael, Caicara de Orinoco; all in Venezuela) — Schultz, 1944, p. 274 (name only).

The following specimens were placed in my hands by Dr. G. S. Myers:

Holotype: CAS 20082, (IU 17685) a specimen 20.8 mm., collected in the Caño de Quiribana, Venezuela, by Dr. Carl Ternetz in 1925.

Paratypes: Eleven specimens in all, as follows: eight specimens, 18.6 to 22.0 mm., formerly IU 17686: CAS 20083 (4 examples), SU 16054 (3 examples), MCZ 31573 (1 example), collected by C. Ternetz in Caño de Quiribana, near Caicara de Orinoco, Venezuela, in 1925. CAS 20084, 2 specimens 22.2 and 23.0 mm., collected in Caño de Quiribana, opposite Pan de Azucar, by C. Ternetz in 1925. CAS 20085, 1 specimen 19.4 mm., collected in creek flowing into Laguna San Rafael, near Caicara de Orinoco, by C. Ternetz in 1925.

Measurements, counts, and proportions of the specimens listed above are recorded, first for the holotype, and then for the paratypes in parentheses. Standard length 20.8 mm. (18.6 to 23.0). Greatest depth of body 520 (510 to 560); interorbital space 154 (138 to 164); least depth of caudal peduncle 115 (99 to 123); distance from tip of snout to origin of anal fin 650 (660 to 705); maximum depth of opercle 212 (167 to 200); length of anal base 345 (302 to 345).

Dorsal rays always 10; anal rays 24 (22 to 24, usually 22 or 23). Seven to nine teeth on each premaxillary, the first the largest, the others decreasing in size backward (Fig. 4a). Mandible with four to six larger teeth, followed backward by 0 to 5 smaller teeth (Fig. 4b.). One or two canine or conical teeth on the maxillary (Fig. 4a).

Coloration (in alcohol) pale brown, band 1 present, prolonged along the border of the thorax to the lower part. Bands 2 and 3 absent. More than five narrower bands on the thorax, these bands running backward and upward, parallel to each other. Band along anal base present, prolonged forward almost to join band 1 on the lower part of the thorax. Dark band along the midaxis of the body, from near upper angle of opercle to midcaudal base, this band bordered with two pale bands, one above and one below it. One band across tip of lower jaw, from eye to eye, another between this band and band 1, from eye to eye across the base of the isthmus. One band from eye to upper angle of opercle. A group of chromatophores forming a band across the opercle below the anterior band and parallel to it.

Named for Martha Ruth Myers (Mrs. G. S. Myers).

Carnegiella schereri Fernandez-Yepez, new species
Figs. 5, 5a, 5b, 5c, 5d.

Carnegiella marthae (nec *C. marthae* Myers, 1927) Myers, 1942, p. 93 (Shansho Caño at Pebas, Peru).

Holotype: SU 36491, a specimen 17.3 mm., collected by W. G. Scherer in Caño del Chancho[2] at Pebas, Peru.

Paratypes: SU 16055, 1 specimen 18.0 and MCZ 19753, 1 specimen 19.2 mm., collected in Lake Hyanuary (Januari) by Thayer Expedition to Brazil in January 1866.

Counts, measurements, and proportions for the three specimens are recorded below for the holotype, and then for the paratypes in parentheses. Standard length 17.3 mm. (18.0, 19.2). Greatest depth of body 540 (540, 530); length of head 272 (272, 264); depth of head 197 (177, 183); diameter of eye 104 (94, 103); interorbital space 144 (150, 137); least depth of caudal peduncle 110 (107, 112); upper caudal peduncle length 207 (227, 213); distance from tip of snout to origin of dorsal fin 750 (720, 720); distance from tip of snout to origin of anal fin 685 (658, 640); origin of pectoral fin to end of anal fin 650 (665, 675); length of dorsal base 98 (112, 81); length of anal base 358 (372, 345); maximum depth of opercle 226 (200, 167); maximum width of opercle 92 (89, 81); longest dorsal ray 150 (177, 152); longest anal ray 144 (156, 162); upper and lower caudal lobes equal, 387.

Dorsal rays 10; anal rays 29 (27, 27); scales between occiput and dorsal origin 20 (20, 20); scales between upper angle of opercle and midcaudal base ? (27, 29). Nine premaxillary teeth, the first the largest (Fig. 5a) the others decreasing in size backward. Mandible with 5 larger teeth and 6 to 9 smaller teeth, the second tooth the largest (Fig. 5b). One canine or conical tooth on the maxillary. Mandible projecting. Greatest depth of body between the first and second third of the standard length. Origin of dorsal fin closer to midcaudal base than to pectoral origin, just a little before the last fourth of the standard length. Maxillary shorter than diameter of eye, almost or quite reaching the horizontal through lower margin of orbit. Predorsal contour nearly straight, and from end of dorsal base to origin of caudal slightly concave. Distance between origin of pelvic and anal fins more or less equal to diameter of eye. First pectoral ray the longest, about two times in the standard length. Pelvic fins small, about equal to maxillary length. Fourth dorsal ray the longest. Thirteenth anal ray the longest.

Coloration (in alcohol) pale brown with a narrow band of chromatophores from the upper angle of opercle to midcaudal base. Band 1 present; bands 2 and 3 absent. A narrow band along the border of the thorax. Band along the anal base present. Chromatophores present on pectoral fin, on opercle and between opercle and origin of pectoral. A dark band across mandible from maxillary to maxillary and another one below, this second running from eye downward and forward and then upward to near the symphysis. Some chromatophores spread on the thorax (Fig. 5).

This new species differs from *C. strigata* and *C. fasciata* in the absence of bands 2 and 3, from *C. marthae* in lacking the narrow parallel bands on the thorax, and from *C. myersi* in the depth of body and in the lower anal ray count. It is most closely related to *C. marthae*, and appears to be the Amazonian representative of that species. It may prove to be only a geographical subspecies; however, since no intergrading material has been seen, it seems best to consider it as a full species for the present.

[2]Called "Shansho Caño" by Scherer.

Named in honor of William G. Scherer, of the Evangelical Mission at Pebas, who collected the type specimen and has provided magnificient help with his collections of fishes from the Peruvian Amazon.

Carnegiella strigata (Günther)
Figs. 2, 2a, 2b, 2c, 2d.

Gasteropelecus strigatus Günther, 1864, p. 343 (type locality unknown); Eigenmann and Eigenmann, 1891, p. 57 (name only).

Carnegiella strigata Eigenmann, 1909, p. 13 (Maduni creek; Gluck Island; Malali; Tumatumari; creek below Potaro Landing; Rupununi Pan; all in British Guiana); Eigenmann, 1910, p. 439 (name only); 1912, pp. 378-379 (Maduni creek; Gluck Island; Malali; Tumatumari; creek below Potaro Landing; Rupununi Pan; Wismar; Rockstone Sand-bank; all in British Guiana).

Gasteropelecus fasciatus (in part) Garman, 1890, p. 10 (Lake Saraca; Cudajás; Manacapurú; all on the Rio Amazonas).

The types are in the British Museum (Natural History). The following specimens were collected by Eigenmann: SU 21793, 2 specimens, 25.2 and 25.5 mm., and SU 21833, 2 specimens, 22.3 and 27.0 mm., both lots from Gluck Island, Essequibo River, British Guiana. SU 21822, 2 juveniles, Maduni Stop-off, British Guiana. CAS 20079, 4 specimens, 25.0 to 26.7 mm., Tumatumari, British Guiana. CAS 20401, 9 specimens, 25.5 to 31.2 mm., creek below Potaro Landing, British Guiana.

The following, collected by the Thayer Expedition, were lent me through the courtesy of Dr. William C. Schroeder: MCZ 21303, 2 specimens, 29.0 and 30.2 mm., Cudajás, Brazil.

The specimens from British Guiana correspond exactly with Günther's description in having four bands on the thorax (band number 3 probably counted as two bands) and in the number of anal rays and scales. It seems probable that Günther's types actually came from Guiana. They agree closely with Gluck Island examples.

Counts, measurements and proportions of specimens listed above (the 2 juveniles were excluded in the measurements) are recorded here. Standard length 22.3 to 30.2 mm. Greatest depth of body, 465 to 500; head, 245 to 298; depth of head, 154 to 188; diameter of eye, 75 to 110; interorbital space, 134 to 153; upper caudal peduncle length, 200 to 232; least depth of caudal peduncle, 89 to 116; distance from tip of snout to origin of dorsal fin, 712 to 740; distance from tip of snout to origin of anal fin, 648 to 675.

Dorsal rays, 10; anal rays, 26 to 29; scales between upper angle of opercle and midcaudal base, 28 to 30. Teeth on each premaxillary, 9 to 11; teeth on each mandible, 16 to 20; one conical (canine) tooth on each maxillary (Figs. 2a, 2b).

Color (in alcohol) pale brown with bands 1, 2, and 3 present (Fig. 2), band 3 divided in two, forming a V-shaped band; band along the anal base present; horizontal bar from upper part of the opercle to midcaudal base present; mandibular band extended through the eye to the end of the opercle, another band from the upper part of the opercle downward to join band 1. Sometimes a light band parallel to and above the horizontal bar. The fins are colorless and transparent, with the exception of the pectoral, which sometimes has chromatophores on the center and base.

Carnegiella fasciata (Garman)
Figs. 1, 1a, 1b, 1c, 1d.

Gasteropelecus fasciatus (in part) Garman, 1890, p. 10 (Tabatinga and Saraca specimens only).

Carnegiella strigata (nec Günther) Eigenmann and Allen, 1942, p. 269 (brook near Iquitos, Peru).

Holotype: MCZ 21289a, a specimen 29.6 mm. in standard length, taken at Tabatinga by Bourget during the Thayer Expedition to Brazil. This specimen is one of the cotypes (syntypes) of *Gasteropelecus fasciatus* Garman and is hereby selected as lectotype of that name.

Paratypes: MCZ 21289b, 2 specimens 22.6 and 26.8 mm., taken at Tabatinga by Bourget during the Thayer Expedition to Brazil.

Other material: CAS 20078, 14 specimens 22.0 to 25.7 mm., collected by W. R. Allen in a brook near Iquitos, Peru, in 1920; MCZ 21296, 1 specimen 23.1 mm., taken in Lagoa Saraca, Brazil, by the Thayer Expedition to Brazil.

Description based on the holotype, the two paratypes, and the specimens collected by Allen at Iquitos and by the Thayer Expedition at Lagoa Saraca.

Measurements, counts, and proportions are recorded below first for the type and then for the others in parentheses. Standard length 29.6 mm. (22.0 to 26.8). Greatest depth of body 580 (524 to 628); head 270 (239 to 274); depth of head 168 (163 to 194); diameter of eye 105 (90 to 109); interorbital space 138 (130 to 155); least depth of caudal peduncle 95 (95 to 109); upper caudal peduncle length 227 (204 to 260); distance from tip of snout to origin of dorsal fin 750 (680 to 790); distance from tip of snout to origin of anal fin 710 (635 to 765); origin of pectoral fin to end of anal base 715 (680 to 750); length of dorsal base 107 (94 to 119); length of anal base 420 (345 to 420); depth of opercle 168 (168 to 208); maximum width of opercle 94 (72 to 108); longest dorsal ray, broken (125 to 174); longest anal ray, broken (143 to 173); upper and lower caudal lobes subequal, the longest ray, 300 ? (362 to 440).

Dorsal rays 10 (9 or 10, usually 10); anal ray 32 (28 to 31, usually 29 or 30); number of scales between occiput and origin of dorsal fin 19 (18 to 20, usually 19 or 20); number of scales between upper angle of opercle and caudal base 28 (28 to 32, usually 29 or 30). Nine tricuspid teeth on each premaxillary, first tooth of the premaxillary the largest (Fig. 1a), the others decreasing in size backward. Mandible with 5 or 6 larger teeth and 0 to 4 smaller teeth, the 3rd tooth the largest. One canine on each maxillary (Fig. 1b). Mandible projecting beyond premaxillary about 3/4 diameter of eye. Posterior tip of the maxillary not reaching beyond horizontal through lower margin of the orbit. Predorsal contour little convex. Origin of dorsal nearer caudal base than to origin of the pectorals. Distance between origin of pelvic and anal fins about equal to diameter of the eye. Pelvic fin shorter than maxillary. First pectoral ray the longest, about 2 times in the standard length. Fourth dorsal ray the longest. Fifth anal ray longest.

Coloration (in alcohol) pale brown with black bands. Live specimens are silvery with the bands nearly black. Bands number 1, 2, and 3 present, the number 3 not divided, forming a single band on the thorax; band along the anal present; dark band from the upper part of the opercle to the midcaudal base, this band is extended through the eye to the tip of the lower jaw; two bands curved upward in the lower part of the suborbital (Fig. 1). The fins are plain with the exception of the pectoral, which sometimes has a few chromatophores.

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IDENTITY OF THE STROMATEID FISH *CENTROLOPHUS CALIFORNICUS* WITH *ICICHTHYS LOCKINGTONI*.— Kenneth L. Hobbs in 1929 (J. Wash. Acad. Sci., vol. 19, no. 20, p. 461) described a presumed new species, *Centrolophus californicus*, from Monterey Bay, California. These specimens were obtained by the describer from within the gastrovascular cavity of the medusa, *Phacellophora*. I saw the three examples alive when Hobbs brought them in, and later preserved them for him.

On several later occasions similar specimens have been taken in Monterey Bay, by Professor R. L. Bolin and others. Examination of these, and comparison of the types of *californicus* with the type of *Icichthys lockingtoni* (Jordan and Gilbert) made several years ago, convinced me that these two species are identical. Hobb's form represents the young. (See Jordan, 1923, Proc. U.S. Nat. Mus., vol. 63, art. 4, for a description and figure of *lockingtoni*.) This note is published to clear the way for some work of Professor C. L. Hubbs, who believes that *Icichthys* grows to a large size, with great change of proportions and appearance.— GEORGE S. MYERS.

SUPPLEMENTARY NOTES ON THE FLYING CHARACID FISHES, ESPECIALLY *CARNEGIELLA*

By George S. Myers

The preceding paper by Mr. Agustin Fernandez-Yepez was written three years ago, during his study tour in the United States. The long delay in its publication has been due to lack of printing funds and of time for the necessary editing of the paper. During the final editorial review, it became evident to the editor that a few remarks upon these interesting fishes should be added to what Mr. Fernandez-Yepez has said about them. These are given here.

Carnegiella consists of the smallest species of the characid subfamily Gasteropelecinae. These are all small fishes provided with a deep "sternum" formed of the greatly expanded, flattened, appressed coracoids. This fanlike structure serves for the attachment of the great muscle-sheets of the pectoral fins. (See Regan, 1911; Starks, 1930; and Gregory and Conrad, 1938; for descriptions and figures).

All of the Gasteropelecinae are known to make extended low leaps above the surface of the water, apparently to avoid enemies. They often "skitter" out in all directions from a canoe passing through creeks and igarapés (cañós) at night. This aerial leaping is performed so rapidly, and so close to the surface of the water, that observation gives us no inkling of the manner in which it is done. However, the presence of the tremendous pectoral muscles, proportionally far larger than those of any other fishes, and the greatly stiffened, rigid and curved nature of the pectoral fins, makes it seem likely that the gasteropelecins move the wings in flight. Moreover, the size of the fish compared to that of its "wings", and the size of the muscles, lead one to the opinion that the wing-motion must be very rapid—a quick vibration or "buzz", perhaps similar to that of the hummingbirds (Trochilidae). Undoubtedly, momentum is gained, and the flight initiated, by a dart through the water, but the form of the fish and its caudal fin makes a preliminary "taxi", similar to that of the marine flying-fishes, seem unlikely.

It is now thoroughly certain, through the careful observations of Breder, Hubbs, and many others, that the marine flying fishes (Exocoetidae) do not move their wings voluntarily during flight. My own extensive observations on these fishes in the waters of California, Central America, the Galapagos, Peru, Hawaii, the Marshall Islands, New Caledonia, and many parts of the open Pacific completely support this view. Movements of the wings during flight are confined to possible slight changes of angle, and to occasional involuntary vibration due to air resistance. The exocoetids are gliders, and their strong but relatively small pectoral muscles are used in flight chiefly to keep the wings as rigidly extended as possible, and possibly to change the wing-angle when necessary. If the gasteropelecins do buzz the wings in flight they are probably the only flying fishes which do, and therefore the only ones to which true flight can be ascribed. The pectoral fins of the West African fresh-water flying fish (*Pantodon*) are almost surely not voluntarily vibrated in flight. This is evident from the structure of the pectoral fin, and from the entire form and lines of the fish, of which I have studied many live examples in aquaria.

The small forms of *Carnegiella* are inhabitants of shaded forest streams and pools, as their color patterns clearly indicate. The much larger, pale, silvery species of *Gasteropelecus* and *Thoracocharax* probably inhabit

more open waters, although our knowledge of the habitats of all these fishes is very meager. In aquaria, all of the gasteropelecins I have observed are surface fishes, never straying far from the upper inch or two of water. They remain almost completely quiescent for long periods, moving only to feed (upon surface organisms) or when disturbed by other small fishes. When frightened, they dart away very quickly and although the confines of a small aquarium do not allow them to fly, it is notable that examples frequently dash themselves to death in captivity. Of the species I have observed most frequently, *Carnegiella strigata* is much more hardy in an aquarium than *Gasteropelecus*, probably because it is less easily frightened. A small *Carnegiella* (first identified as *marthae* but perhaps really *schereri*; see Myers, 1934) is even more easily kept in home aquaria.

In his revision, Mr. Fernandez-Yepez has pointed out that two forms recognized as species, *fasciata* and *schereri*, are closely related, respectively, to *strigata* and *marthae* and may eventually prove to be specifically identical with those forms. On my part, I am already practically convinced that only lack of material prevents demonstration of subspecific relationship between *strigata* and *fasciata*, even though Mr. Fernandez-Yepez has in effect overlapped the ranges of these forms in the middle Amazon (see locations of Cudajás and Lagoa Saraca) without finding intergradation.

The known ranges of *marthae* (Orinoco) and *schereri* (Peruvian Amazon) are very distant from one another, and Mr. Fernandez-Yepez has utilized the absence of narrow thoracic color lines in *schereri* as a specific character. While there may be a difference in these lines, in the two forms, I am almost certain that *schereri* will show them to some degree. In 1934 I reported upon live aquarium examples of *marthae* said to be from Manaos. While I am not certain that the locality information given me with the live fishes was accurate, I have strong reason to believe that they were not from the Orinoco and were almost certainly Amazonian. They should, then, have possessed no thoracic lines, because *schereri* is the Amazonian form. However, as I pointed out very clearly in my article, the lines were sometimes present and sometimes quite invisible, depending upon the color phase exhibited by the fish at the moment. I have no confidence in the mere presence or absence of these lines as a systematic character. Again, I feel confident that these two forms will eventually be called subspecies.

If these beliefs are borne out, *Carnegiella* will consist of three species, *myersi*, *marthae*, and *strigata*, all representing very distinct specific populations, partially or wholly sympatric in nature.

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STUDIES ON SOUTH AMERICAN FRESH-WATER FISHES. II.
THE GENERA OF ANOSTOMINE CHARACIDS

By George S. Myers

When Mr. Agustin Fernandez-Yepez was at Stanford in 1947, he worked upon several anostomine Characidae from Venezuela, including a new genus which I had had in manuscript for a number of years. This was to be published jointly, but time did not permit of my completing the paper for publication until recently. In order to place the new genus more securely, it was found necessary to do a great deal of revisional work on the classification of the anostomines and to re-examine considerable material from the upper Orinoco which Mr. Fernandez-Yepez had provisionally identified in 1947. Amongst this material were the types of several supposed new species and subspecies of the group, especially of the genus *Anostomus*, which Mr. Fernandez-Yepez had labelled, and of which he presumably took descriptions and figures back to Venezuela with him. Unfortunately, none of these supposed new forms of *Anostomus* is valid, and it became necessary for me to revise that genus.

This paper therefore represents a brief generic review of the group Eigenmann called Anostomatinae (better Anostominae) in 1912 (Mem. Carnegie Mus., vol. 5, p. 254, in key), which is less inclusive than his previous characterization in 1909 (Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 3, p. 254). It is also far less inclusive than Regan's family Anostomidae. This is not a complete, well-rounded, generic revision, simply because time has not allowed. The paper consists principally of a generic key or synopsis, followed by a generic list. One part of the paper, the description of the genus *Synaptolaemus* and of its type species, *S. cingulatus*, is a joint contribution by Mr. Fernandez-Yepez and myself. Mr. Fernandez-Yepez also did part of the drawings. Others are by myself or by Mr. Pablo Bravo. All the rest represents my own work.

It may be remarked that no previous attempt to compare and define all of the included genera has been made, and that most of the generic characterizations scattered through the literature, even those by Eigenmann, have been found to be almost worthless.

The present synopsis must be used with great care, for although it is based upon personal examination of more than half the known species, it probably will not work in a few instances. Aside from the dentition and mouth form, the anostomines possess very few external characters of use in generic segregation, and the mouth form and dental morphology in the large genus *Leporinus* differ considerably from species to species. Moreover, my own work shows that age has considerable to do with tooth form in some species, particularly in *Schizodon* and its relatives. Larger examples sometimes seem to have the teeth so worn down that the original tooth structure is almost or quite obscured. However, I am not at all sure that a few of these difficulties are not due to misidentification. Once the mouths and teeth of most of the species of *Leporinus* have been properly described *and* figured, we shall be in a better position to assess the value of generic groupings, but, so far as the author knows, this type of examination has never been made for a single species of *Leporinus*, even in preparing the beautiful Agassiz plates published by Borodin. The trouble is that proper understanding of the dental characters of the fishes of this group cannot be conveyed clearly without accurate and well executed drawings of the teeth from three different positions: (a) from the front of the teeth of each jaw, (b) *in apical view*, to show the tooth arrangement and the cut-

ting edges, and (c) *from the inside*, to show the pattern of cutting edges on the posterior side. I do not at present have the facilities to do this. The key below, frankly artificial in nature, has been constructed with the intention of making generic groups now recognized by the author as accurately identifiable as possible without extensive illustration.

Aside from the difficulty just mentioned, there are several others to be faced. *Anostomoides* Pellegrin (1908, Bull. Mus. Hist. Nat. Paris, p. 346; based on *A. atrianalis* Pellegrin, type locality Rio Orinoco) is insufficiently described for our purposes. It may be related to *Synaptolaemus* and it may not. Certainly it is not the same fish and has not been included in the key. *Rhytiodus*, although a perfectly distinct genus, is nowhere adequately described, and although I have good material of the three species, the dental changes it apparently undergoes with age makes verbal separation difficult. As to *Synaptolaemus* and *Gnathodolus*, both are very distinctive, but I am not sure whether they are really closely allied (as has been assumed) or whether the former sprang from the *Leporinus* line (its teeth are in many ways *Leporinus*-like) and the latter from something near *Anostomus*. Finally, with *Schizodon* and *Laemolyta*, the distinction seems simple, but may be deceptively so. Our specimens of *L. taeniata* from Pebas, Peru, are so similar to what we tentatively call *S. isognathus* from Caicara del Orinoco that I suspect close relationship.

As a guide to the user, it may be helpful to point out that most fishes of this group which come to hand will be *Leporinus*. None of the genera but that one occurs west of the Andes except in the Rio Magdalena, where *Leporellus* and *Abramites* also are found. All the genera inhabit the Amazon and Orinoco basins and the streams of Guayana (Guiana). In the Plata system and southeastern Brazil, only *Leporinus, Abramites, Leporellus, Schizodon* and *Laemolyta* occur. As a last word, I again wish to point out that this key is likely occasionally to fail, especially in placing specimens of *Leporinus* in their proper genus.

GENERIC SYNOPSIS

1a. Caudal fin scaled for half or more of the length of the lobes; narial openings closely approximated, the anterior with a large but very short tube, the posterior rim of which is expanded into a flap; head and body compressed, especially in young.....LEPORELLUS Ltken

1b. Caudal fin scaled only basally, except that in some forms the basal scalation extends out in a median projection to cover over the median rays halfway or more to their tips; narial openings more or less remote, lying in the same depression, the anterior one tubular but not expanded into a flap.

2a. Mouth superior, the lower jaw being strongly and clearly vertical when mouth is closed; snout round to vertically ovate in cross-section.

3a. Lower jaw (the bony structure, minus the teeth) at least 5 times as long as broad, without teeth except for the symphysial pair, which are excessively elongate, projecting straight out from the end of the jaw, and partly sickle-shaped, partly spoon-shaped at the tip; upper dentition consisting of 4 small weakly hastate teeth on each side; snout excessively deep, the mouth opening narrow and vertical.....GNATHODOLUS Myers

3b. Lower jaw (the bony structure, minus the teeth) not much over twice as long as deep, usually less; at least 6 teeth in lower jaw.

4a. Lower jaw at least twice as long as broad; snout deep, vertically ovate in cross section; upper jaw with 8 teeth, the 4 anterior teeth narrow, flattened, weakly recurved, smoothly rounded at ends, the 2 lateral teeth on each side each with one cusp on its laterad side (middle 4 teeth show a remnant of this cusp in young); lower jaw

with a symphysial pair (one on each side) of narrow, greatly enlarged, round-tipped, faintly spoon-shaped teeth, the other (lateral) teeth broad, flattened, curved forward and upward and weakly tricuspid, the posteriormost very small; color pattern (in life) of narrow, orange-red rings around a chocolate-brown body; gill-membranes very broadly united with isthmus.....SYNAPTOLAEMUS, new

4b. Lower jaw about as long as broad; snout rounded in cross section; upper and lower teeth cuspidate (wearing down somewhat with age) without the symphysial teeth enlarged.....ANOSTOMUS Scopoli

2b. Mouth terminal, inferior, or slightly upturned, never with the lower jaw as long as or longer than broad *and* strictly vertical in position when mouth is closed.

5a. Mouth terminal, very narrow; body elongate; *teeth thin and compressed*, but of remarkable form; *all teeth much broader than long*, very assymmetrical, the root being to one side (laterad) of the middle of each tooth, more than half the tooth thus being mesad of its base; lower teeth with an oblique, *concave* cutting edge, rising on the mesad side to one or two points and laterad to one; in old specimens frequently worn down to a flat cutting edge except for a median concave section; upper teeth either obliquely oval incisors (long edge laterad), or with a small added cusp on mesad side; caudal lobes long, the fin large; basal scalation of caudal extending far out on middle rays; head broad and flattened but convex above, with a wide adipose eyelid anteriorly.....RHYTIODUS Kner

5b. Mouth not notably narrow, the body usually (but not always) less elongate, and the teeth not as described above; usually the teeth are fairly heavy, and they are *always as long as or longer than broad*, at least in front.

6a. Teeth heavy and thick at base; those of upper jaw arranged in a step- or stair-like pattern, the symphysial pair set far forward and largest; each tooth which follows set as much *behind* as to the side of the preceding tooth; the cutting edge at the more or less broad apex of each upper tooth is *transverse* to the long axis of the fish (not quite strictly transverse in a few species); thus the upper teeth are *not* set side by side along (and following) the curve of the upper jaw, and the cutting edge they all form together is (from the apical view of the teeth) sinuous and step-like; lower teeth all slanted forward to the symphysial pair which is largest, the teeth lateral to that pair (and often the symphysial pair as well) with an oblique and usually concave cutting edge; mouth slightly upturned, terminal, or inferior.....LEPORINUS Agassiz

6b. Teeth generally less heavy; those of upper jaw *not* set one behind and to the side of the preceding tooth; the upper teeth are set side by side, following the curve of the jaw, and the cutting edge formed by all the upper teeth (often or usually cuspid) therefore, follows the curve of the jaw and is not sinuous and step-like.

7a. Lower teeth as in *Leporinus*, the symphysial pair largest and the others slanted strongly forward towards that pair; upper teeth flattened and cuspidate; body deep and compressed; post-pelvic edge of belly compressed into a keel.....ABRAMITES Fowler

7b. Lower teeth not as in *Leporinus*, the symphysial pair not greatly enlarged and inclined far forward and the teeth to either side neither very strongly inclined towards the symphysial pair nor with a concave, oblique cutting edge; body more elongate; post-pelvic edge of belly rounded.

8a. Both upper and lower teeth cuspidate.....SCHIZODON Agassiz

8b. Upper teeth more or less cuspidate, occasionally truncate; lower teeth truncated incisors.....LAEMOLYTA Cope

Genus *LEPORELLUS* Lütken

Leporellus Lütken, 1874, Overs. K.D. Selsk. Forh., no. 3, p. 129 (type *Leporinus pictus* Kner by subsequent designation of Eigenmann, 1910, Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 4, p. 427).

Leporinodus Eigenmann, 1923, Mem. Carnegie Mus., vol. 9, p. 116 (type by original designation *Leporinodus retropinnis* Eigenmann).

There has been considerable confusion over this genus, as to whether it represents two or only one. Lütken stated that it had gill-membranes "plane libera, ad superficiem inferiorem capitis haud adnata,—quibus characteribus ad *Tetragonopterinos* accedit." Most specimens of this group have the gill-membranes rather broadly fused to the isthmus, and (in the absence of specimens from Lütken's locality, the Rio das Velhas near Lagoa Santa) upon this basis Eigenmann described *Leporinodus*. Lütken's observation was almost certainly in error, but if it was correct, there will arise a question as to the generic type of *Leporellus*. Lütken originally mentioned just two species, "*L. pictus* Kner.(*L. vittatus* Val.?)." The second name, with a questionmark, indicates doubt that *vittatus* equals *pictus*, not, in all probability, that Lütken doubted that *vittatus* was a *Leporellus*. Therefore two names were referred to the genus, neither doubtfully, and the generic type is open to subsequent designation. Eigenmann designated *pictus* in 1910. However, later events have demonstrated that the S. Francisco basin form Lütken had is almost certainly neither *pictus* nor *vittatus* but probably a distinct form, for which the name *maculifrons* and *timbore* are available. The forms have been keyed out and the names and references listed by Schultz (1944, Proc. U.S. Nat. Mus., vol. 95, pp. 265-266).

Genus *GNATHODOLUS* Myers

Gnathodolus Myers, 1927, Bull. Mus. Comp. Zool. Harvard, vol. 68, p. 108 (type by original designation *G. bidens* Myers).

This genus consists only of the type species, *Gnathodolus bidens* Myers, one of the strangest of all Characidae, a family abounding in unusual forms. It is still known only from the three type specimens, one in the Museum at Harvard and two now in the California Academy in San Francisco. The holotype (CAS 20087) has been in our hands for re-examination, but the other Academy specimen has become mislaid. The species is here figured for the first time, from drawings made in 1930 by Pablo Bravo, and in 1947 by Mr. Fernandez-Yepez.

G. bidens is plainly derived from the *Anostomus* line through some form probably not distantly related to *Synaptolaemus*, in which the teeth had lost the ancestral cusps and in which the front pair of lower teeth had become enlarged. From such a form *Gnathodolus* evolved by a deepening and narrowing of the whole snout, mouth opening, and lower jaw, until the mouth opening is a narrow, vertical slit, which is closed by the long, narrow, slender lower jaw, so narrow indeed that the rami are appressed for most of their length. The mandibular dentition has been lost save for the middle pair, which have become greatly elongated; they surmount the tip of the mandible and are so enlarged and elongate that they extend far above the upper end of the snout when the mouth is closed. Their peculiar sickle-shaped form, when seen from the side, is shown in my drawing (Fig. 1a). The superior dentition has become weakened and simplified, showing four simple, lance-headed teeth on each side. The eye-position has also been modified. Anteriorly, the eyes are set out from the sides of the head, so

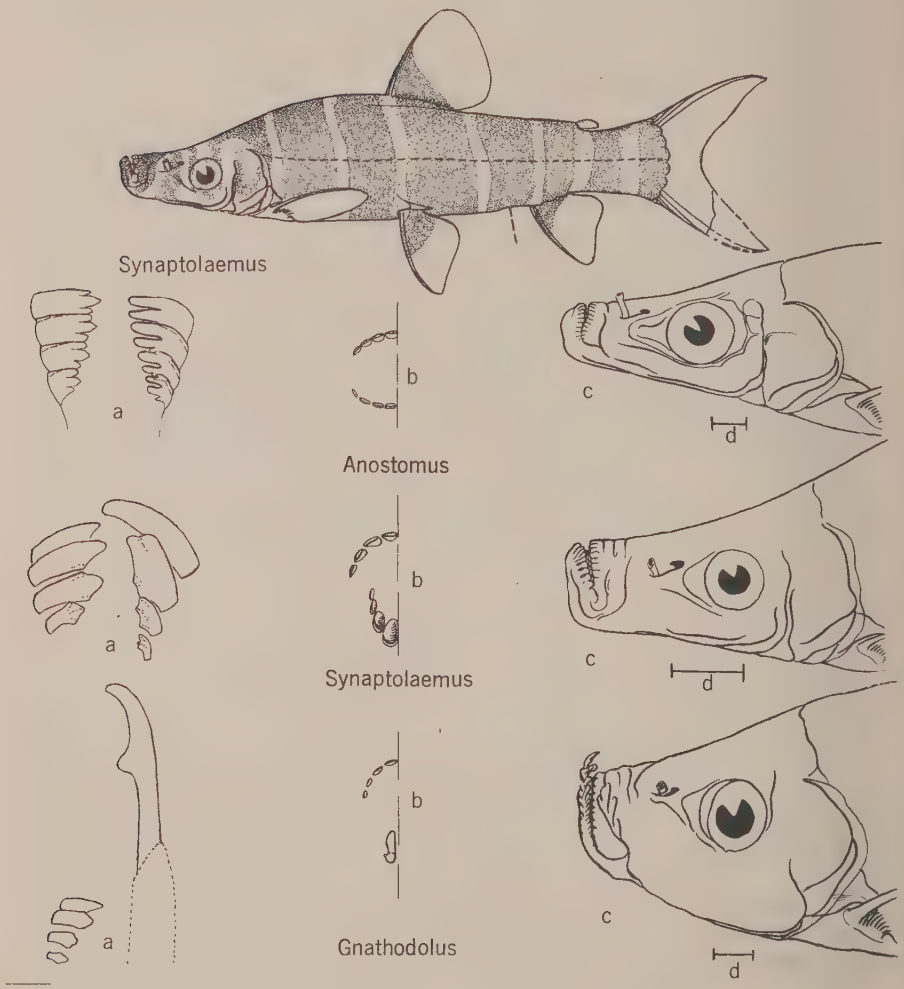

FIG. 1. Comparison of Synaptolaemus and related genera. A, Enlarged view of right premaxillary (to left) and right mandibular (to right) teeth, showing approximate relation of upper to lower teeth when mouth is nearly closed. (Teeth of Anostomus from front view, of others from side view.) B, Position of teeth on jaws, right premaxillary above, right mandible below. C, Side view of head. D, Width of isthmus, same scale as head. (Drawn by A. F.-Y. except for A of Synaptolaemus and Gnathodolus, which are by G.S.M.)

FIG. 2. Gnathodolus bidens Myers. Holotype, from Chemoni, Canal de Casiquiare, near the Bifurcation of the upper Rio Orinoco, Venezuela; coll. Dr. Carl Ternetz. Standard length 113 mm., total length 134 mm. Inset shows top of head. (Drawn by Pablo Bravo.)

that they do not face laterally or anterolaterally, as in most fishes. Instead, they face somewhat posterolaterally. This is shown in Mr. Bravo's sketch, drawn after the eyes had sunken in, after long preservation. When the author first saw the types, three or four months after initial preservation, this feature was much more easily seen. The plications or papillae which are seen on the lower jaw of *Synaptolaemus*, have become elongated and still more dense especially about the tip of the lower jaw of *G. bidens*. Finally, the caudal fin has apparently assumed an atypical form, as shown in the illustration. It was thought at first that this was due to injury, but the one paratype with a complete caudal, had a caudal of identical form with that of the holotype, even though from a different locality.

Gnathodolus comes from the same area as *Synaptolaemus*, the "Bifurcation" of the Orinoco and the Rio Casiquiare, in Venezuela. The name is derived from the Greek, *gnathos*, jaw, and *dolos*, trap, and from the Latin, *bidens*, with two teeth.

Genus *SYNAPTOLAEMUS* Myers and Fernandez-Yepez, novum

Generic type: *S. cingulatus*.

Mouth superior, the lower jaw (the bony structure, minus the teeth) twice as long as broad and vertical in position when mouth is closed. Snout long, deep, vertically ovate in cross-section. Caudal with basal squamation. Eight teeth on each jaw. The four anterior teeth in the upper jaw are narrow, somewhat flattened, concave behind, weakly recurved, and smoothly rounded at the ends, the two smaller lateral teeth on each side each with a cusp on its laterad side. The middle four teeth show a remnant of this cusp in small examples. Lower jaw with an enlarged symphysial pair of narrow, round-tipped, faintly spoon-shaped teeth, the teeth to the side broad, flattened, curved forward and upward, and weakly tricuspid, the last tooth very small. Gill-membranes much more broadly united to the isthmus than in *Anostomus* and *Gnathodolus*. Probably a representative of the stock from which *Gnathodolus* evolved, but the teeth and the color pattern are suspiciously like those of some species of *Leporinus*.

Synaptolaemus cingulatus Myers and Fernandez-Yepez, sp. n.

Holotype: SU 16122, 71.5 mm. standard length, collected April 6, 1925, in Laja Supira, upper Rio Orinoco, Venezuela, by the late Dr. Carl Ternetz.

Paratypes: Seven examples, as follows: CAS 20114 (3 examples), SU 16123 (2 examples), from 63 to 109 mm. standard length collected March 24, 1925 at Laja Tama-Tama, at the Bifurcation of the Orinoco, by C. Ternetz. SU 16124 (2 examples), collected March 13, 1925, in the entrance (source) of the Canal (or Rio) Casiquiare, near the Bifurcation, by C. Ternetz.

The description is based on the specimens listed above, first for the type and for the paratypes in parentheses.

Head, 3.68 (3.88 to 3.95) times; depth of body, 4.38 (4.2 to 4.75); distance from tip of snout to dorsal origin, 2.05 (2.03 to 2.08); distance from tip of snout to pelvic origin, 1.85 (1.78 to 1.85); distance between pelvic and anal origins, 4.06 (3.72 to 4.12); distance between origin of ventral fins, 15.2 (12.7 to 14.2); length of caudal peduncle, 6.80 (6.65 to 7.00); least depth of caudal peduncle, 9.00 (8.82 to 9.4); all in the standard length. Width of the head, 2.2 (2.1 to 2.25); snout, 2.4 (2.35 to 2.6); diameter of orbit, 3.3 (3.3 to 3.85), all in the length of the head. Interorbital space, 1.00 (1.00 to 1.2) diameter of eye.

Scales: predorsal, 12 (10 to 12); between dorsal origin and lateral line (4 or 5, usually 4) in lateral line, 38 (36 to 38, usually 36 or 37); below lateral line to origin of pelvics, 3 (always 3).

Dorsal rays, 12 (12 or 13, usually 12); anal rays, 11 (10 to 12, usually 11).

Upper lip strongly plicate, the lower developed into numerous barbel-like structures, as in *Gnathodolus*. Nostrils widely separated, the anterior tubular. Eye set low. Dorsal profile from snout to dorsal weakly S-shaped, concave on top of head, convex on predorsum. Dorsal fin origin approximately in middle of standard length, barely anterior to pelvic origin.

Color of alcohol specimens dull brownish with seven narrow light rings encircling the body, the first just behind the head, at pectoral origin, the third at dorsal and pelvic origin, the fifth at anal origin, and the seventh midway between adipose fin and tail-root. At the tail-root, the color darkens, and although the caudal fin is pale, a still paler semicircular band borders the dark tail-root. There is a light curved vertical band through the opercle and another, narrower, straight one just behind the eye and a similar one just before it. Finally there is an oblique light band just behind the dark mouthparts. Dorsal, pelvics and anal dark basally, the color running higher on the anterior rays. Adipose basally yellow, with a black end. In the fresh specimens, when the author unpacked them in 1925, the body was chocolate brown and the rings pale orange-red.

Sunaptos (Greek), joined together; *laimos* (Greek), throat; from the broad union of the gill-membranes with the throat. *Cingulatus* (Latin), ringed.

Genus *ANOSTOMUS* (Gronow) Scopoli

Anostomus Gronow 1763, Zoophylacium, fasc. 1, p. 122 (not accepted by International Commission).

Anostomus Scopoli 1777, Introductio ad historiam naturalem, p. 451 (no species mentioned but clearly based on Gronow, so that the type by monotypy must be Gronow's species, which is *Salmo anostomus* Linnaeus).

Anostoma Rafinesque 1815, Analyse de la nature (not seen; an emendation of *Anostomus*).

Mormyrhynchus Swainson 1839, Nat. hist. fishes, amphibians and reptiles, vol. 2, pp. 186, 291 (type by monotypy *M. gronoveii* Swainson equals *Salmo anostomus* Linnaeus).

Histiodromus Gistel 1848, Naturges. Thierreichs (not seen; said by Jordan to be based solely on *Salmo anostomus* Linnaeus).

Pithecocharax Fowler 1906, Proc. Acad. Nat. Sci. Philadelphia, p. 319 (type by original designation *Salmo anostomus* Linnaeus; proposed in the mistaken idea that *Anostomus* is preoccupied).

This genus, as here defined, is restricted to the Amazon and Orinoco basins and the streams of Guayana (Guiana), that is, the country north of the Amazon and east of the Rio Negro and Rio Orinoco. Four or five species are known. They may be distinguished as follows:

1a. Body dark brown with two longitudinal yellow lines down each side (enclosing a broad median band of the ground color), another yellow line along the belly, and a variable number of narrower yellow lines on the dorsum; a slender species, reaching not much over 125 mm..... .....*A. anostomus* (Linnaeus)

1b. No yellow longitudinal stripes; color pattern consisting of vertical bars or lines, dotted longitudinal lines (one on each scale-row), a series of two to four dark blotches along the midline of the sides, or a combination of part or all of these.

2a. Origin of dorsal fin exactly midway between snout-tip (upper lip) and end of hypural fan; snout long, its dorsal profile concave, rising to a convex predorsum; color pattern consisting of dark longitudinal lines *between the scale-rows*, narrow irregular vertical cross-lines, and four midside blotches—the first humeral in position, the second subdorsal (longitudinally elongate), the third supra-anal, and the last at tail-root; known only from the highlands of British Guiana.... .....*A. plicatus* Eigenmann

2b. Origin of dorsal fin midway between snout-tip (upper lip) and a point just posterior to end of adipose fin; if there are dotted longitudinal lines they are at the middle of the scale-rows, not at the margins.

3a. Color pattern consisting only of broad dark vertical bars on a lighter ground color, the bars as wide as the interspaces; a doubtful form based on one young fish from the Peruvian Amazon; perhaps the young of *trimaculatus*.....*A. ucayalensis* (Fowler)

3b. Color pattern not consisting solely of broad vertical bands.

4a. Predorsal profile continuously but weakly convex and the top of the head flat, or only with the faintest concavity (in the young) at top of head and snout; body very slender, depth 4.2 to 4.6 in standard length; color pattern consisting of strong dark dotted lines along middle of each scale-row, often without or with two to four dark midside blotches, these sometimes replaced by a plumbeous lateral midside band; no vertical lines or bars.....*A. gracilis* (Kner)

4b. Predorsal profile S-shaped, concave over the snout, rising to a strong convexity on mid-dorsum; body deeper, depth 3.5 to 4.0 in standard length; color pattern consisting of dark dotted longitudinal lines along middle of each scale-row (these dotted lines are *light* in Peruvian Amazon examples), one to four lateral black midside blotches, *and a series of narrow dark vertical lines across the dorsum*.....*A. trimaculatus* (Kner)

Anostomus anostomus (Gronow) Linnaeus 1758. A good account of this species, including a colored plate, is given by Eigenmann (1912, Mem. Carnegie Mus., vol. 5). For a photo and account of aquarium specimens see Innes (Exotic aquarium fishes). There are two or three color varieties present in the upper Orinoco-Casiquiare region. The most distinctive has many dark and light longitudinal lines on the dorsum, corresponding to the scale rows. However, these varieties do not seem to represent even subspecies for they do not appear to have much of any geographical correlation.

Anostomus plicatus Eigenmann 1912 (Mem. Carnegie Mus., vol. 5). This species is not represented in our collections from the Casiquiare, Rio Negro, or upper Orinoco in the Bifurcation region. It is known only from high altitudes in British Guiana. It is close to *A. trimaculatus*.

Anostomus ucayalensis (Fowler) 1906 (Proc. Acad. Nat. Sci., 1906, p. 320, fig. 16; Rio Ucayali). Based on a single young example. It may represent the young of *trimaculatus*.

Anostomus gracilis (Kner) 1858. This species, hitherto known only from the single small holotype from the Rio Guaporé collected by Natterer, proves to be common in the upper Orinoco and Casiquiare. It is the largest species of the genus, reaching at least 163 mm. in standard length. It is not very closely allied to *trimaculatus* and *plicatus* but is probably closer to *A. anostomus*.

Anostomus trimaculatus (Kner). We have this common species from Pebas, Peru (Scherer, coll.), and in numbers from the upper Orinoco and Casiquiare.

Genus *RHYTIODUS* Kner

Rhytiodus Kner 1858, Sitzb. Akad. Wiss. Wien, Math.-natur. Cl., vol. 30, p. 78 (not seen); 1859, Denks. Akad. Wiss. Wien, Math.-natur. Cl., vol. 17, p. 165 (type *R. microlepis* Kner by subsequent designation of Fowler, Proc. Acad. Nat. Sci. Philadelphia, 1906, p. 326 and of Eigenmann 1910, Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 4, p. 425).

Garmanina Fowler 1906, Proc. Acad. Nat. Sci. Philadelphia, 1906, p. 326 (type by original designation *R. argenteo-fuscus* Kner).

This little known genus seems to have received no critical treatment based on new material since Kner's original descriptions and figures of 1859 (see synonymic reference). *Schizodon elongatus* Steindachner (1908, Anz. Akad. Wiss. Wien, 1908, no. 6, p. 2 of separate; type locality Rio Purus; also Bol. Mus. Goeldi, vol. 5, p. 451) should stand as *R. elongatus* if the example recorded by Starks (1913, Fishes Stanford Exped. Brazil, Stanford Publs., p. 15) from the upper Rio Madeira is, as I believe, correctly identified (SU 22427). It has still larger scales than *R. argenteo-fuscus*, which I have from Pebas, Peru. I have *R. microlepis* from Iquitos.

Genus *ABRAMITES* Fowler

Abramites Fowler 1906, Proc. Acad. Nat. Sci. Philadelphia, 1906, p. 331 (type by original designation *Leporinus hypselonotus* Günther).

It is surprising to discover that this genus is perfectly well defined by dental characters in addition to the deep body, post-pelvic keel, and long anal fin (24 to 34 rays). Norman (1926, Ann. Mag. Nat. Hist., ser. 9, vol. 18, pp. 92-94) has reviewed the genus and described two new species, one from the Rio Paraguay. I have seen *A. hypselonotus* from Pebas, and live *A. microcephalus*. Innes (Exotic aquarium fishes) gives an account of the latter in the aquarium. These fishes, like *Anostomus* and several other members of the group, habitually rest at an angle, head down.

Genus *LEPORINUS* Agassiz

Leporinus (Spix) Agassiz 1829, Selecta genera pisc. Brasil., pp. 58, 65 (two species included; type *L. novemfasciatus* (Spix) Agassiz equals *Salmo fasciatus* Bloch, by subsequent designation of Eigenmann 1910, Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 4, p. 426).

Myocharax Fowler 1914, Proc. Acad. Nat. Sci. Philadelphia, 1914, p. 239 (type by original designation *Leporinus desmotes* Fowler).

Hypomasticus Borodin 1929, Mem. Mus. Comp. Zool. Harvard, vol. 50, p. 272 (type by original designation *Leporinus mormyrops* Steindachner).

This is one of the large, dominant genera of medium sized South American Characidae. Many of the forms are common foodfishes. The species have nowhere been revised as a whole since Günther (1854, Cat. fishes Brit. Mus., vol. 5), when very few were known. Eigenmann (1912, Mem. Carnegie Mus., vol. 5; 1923, Mem. Carnegie Mus., vol. 9) has reviewed the species of British Guiana and of Transandean South America. Borodin (1929; see reference in synonymy) has reviewed the species in the Harvard museum; this is an important paper, not for its author's work, which is bad, but for the excellent plates, made under Louis Agassiz's and Garman's direction, and for its rather complete coverage of Brazilian Amazon forms. However, even the Agassiz plates do not sufficiently and accurately illustrate the dentition (see discussion, supra). Eigenmann (1910, Reports Princeton Univ. Expeds.

Patagonia, Zool., vol. 3, pt. 4, p. 426) lists all the Cisandean species described up to 1908 or 1909, and it is my understanding that Dr. Haroldo Travassos of the Museu Nacional, Rio de Janeiro, is soon to issue a new list of all South American characids. Fowler (1945, Los Peces del Peru, Lima) has published a list of Peruvian fishes, including *Leporinus*, and is publishing a similar list for Brazil (Arq. Zool. S. Paulo). Norman (1926, Ann. Mag. Nat. Hist., ser. 9, vol. 18, p. 94) and Puyo (1949, Poissons Guyane Française, in: Faune de l'Empire Française, vol. 12) have described some French Guiana species. Borodin (loc. cit.) and Steindachner (1875, Sitzb. Akad. Wiss. Wien, Math.-natur. Cl., vol. 71) treated forms from southeastern Brazil, upon which Sra. Antonia Amaral Campos has also recently published (1945, Papeis Avulsos, Dept. Zool., S. Paulo, vol. 5, no. 16). Uruguayan forms are treated by Devincenzi and Teague (1942, An. Mus. Hist. Nat. Montevideo, ser. 2, vol. 5, no. 4) and Rio Magdalena ones by Miles (1947, Los Peces del Rio Magdalena, Bogotá).

The genus is still in confusion, however, and it is probable that many authors who have reported species (except west of the Andes) have misidentified some of them. The discussion preceding my key to the genera will clear up some of the reasons.

Only two subgenera have been proposed, *Myocharax* and *Hypomasticus*. The former is based upon a species with a nearly terminal mouth, but the fact that I cannot interpret Fowler's description of the teeth emphasizes the difficulty in describing the dentition, a subject discussed just before my key (supra). *Hypomasticus* is apparently clear enough, but if the Agassiz plate is correct, the teeth are unlike any I have seen in *Leporinus* and probably do not agree with my diagnosis of the genus in the key.

FIG. 3. Diagrammatic apical view of the left premaxillary teeth of a Leporinus, drawn principally from L. brunneus, to show the step-like or stair-like arrangement of the teeth and the cutting edges. (Sketched by G.S.M.)

The following general description of the teeth may now be given. Teeth of upper jaw (6 or 8 in number) heavy, arranged in a step-like manner, the symphysial pair far out in front and each succeeding tooth set back quite as far behind as laterad of the preceding one. In spite of this, the main axis of each tooth, as determined by the long (transverse) axis of the cutting edge, is more or less transverse to the axis of the fish. Thus, the continuous, more or less even cutting edge (following the curve of the jaw) achieved by the juxtaposed teeth of most anostomines is transformed into a step-like series of cutting edges (one to a tooth) each edge being more or less transverse to the axis of the fish's body. Lower teeth 6 or 8 in number, the symphysial pair enlarged, inclined forward, curved towards each other from the root, the more posterior teeth all inclined towards the

symphysial pair. This type of dentition has been verified in *L. fasciatus, friderici, nigrotaeniatus, maculatus, megalepis, ecuadoriensis, striatus, brunneus,* and others of which the identification is less secure.

Leporinus brunneus, sp. n. Holotype.—SU 16125, a specimen 150 mm. standard length, collected at Caxoeira Camanaos (Camanaos Rapids), Rio Negro, Brazil, Jan. 23, 1925, by the late Dr. Carl Ternetz. Paratypes.—Three examples from Chemoni, near the Bifurcation del Orinoco, Venezuela, by Ternetz, March 13, 1925. There are also several other paratypes from the vicinity of the Bifurcation and from San Fernando de Atabapo.

A slender, more or less unicolor species with a slightly to rather strongly inferior mouth, and lacking any stripes, bands or spots. Depth in most examples about equal to head length, something over 4 times in standard length. Body somewhat compressed and flat-sided, not terete. Dorsal origin midway between snout-tip and a point just behind end of adipose fin. Pectorals reaching somewhat more than half-way from their base to pelvics. Pelvics originating under base of fifth or sixth dorsal ray, reaching just half-way from their base to the anal fin. Anal fin, when folded, not reaching caudal. Adipose over bases of last three caudal rays. Scales 5/38-41/5 (to pelvic).

Counts of holotype: D. 12. A. 11. Pelvic 10. Pect. 18. Caudal 19 principal rays. Lateral line 39, plus 2 or 3 on caudal base. Transverse scales 5/1/5. Around peduncle 16. Predorsal scales 12.

Measurements, in mm., of holotype: Standard length 150. Head length 38. Greatest body depth 36. Greatest breadth (at opercles or cleithrum) 20. Eye 11. Bony interorbital 8. Length snout 17. Breadth mouth (end one maxillary to the other) 12. Snout-tip to dorsal fin 72. Snout-tip to pectoral base 38. Length pectoral fin 24. Snout-tip to pelvic origin 76. Length pelvic fin 25. Snout-tip to anal fin origin 123. Length anal fin 23. Least depth caudal peduncle 14.

Color in alcohol: Dull yellowish brown, darker above, the caudal tips blackish. The coloration is composed chiefly of a heavy dark edging to every scale, surrounding a center area of yellowish silvery or golden. Maxillary blackish. Fins except caudal pale. A small specimen from the upper Orinoco exhibits many rather narrow, wedge-shaped dark vertical bands across the dorsum, broad above, narrow below, these enlarging at midsides to form a very faint longitudinal midside series of darkish blotches.

This species does not seem to be especially close to any other in the genus. The type has the mouth broader and more inferior than the Venezuelan paratypes, a characteristic which is seemingly somewhat variable in the anostomines.

Genus *SCHIZODON* Agassiz

Schizodon Agassiz 1829, Selecta genera pisc. Brasil., pp. 58, 66 (two species included; type *S. fasciatus* Agassiz, by subsequent designation of Eigenmann 1910, Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 4, p. 425).

?Nanognathus Boulenger 1895, Bol. Mus. Zool. Anat. Comp. Univ. Torino, vol. 10, no. 196, p. 2 (type by monotypy *N. borellii* Boulenger).

Labilliella Eigenmann and Kennedy 1903, Smithsonian Misc. Coll., vol. 45, p. 144 (type by original designation *Schizodon nasutus* Kner).

In this genus the mouth is terminal or somewhat inferior and the teeth of both jaws are cuspidate. The species are in great confusion despite the revisional work of Garman (1890, Bull. Essex Inst., vol. 22, pp. 15-23), which is excessively brief and not illustrated, and of Borodin (1931, Bull. Mus. Comp. Zool. Harvard, vol. 72, no. 2), which is very poorly done and is

saved only by the excellent plates, in part done under the guidance of Louis Agassiz and Garman and in part copied from Kner (1859, Denks. Akad. Wiss. Wien, Math.-natur. Cl., vol. 17).

One thing is certain. This is that *Lahilliella* is valid neither as a genus nor a subgenus, for its type, *nasutus*, is scarcely specifically distinct from *Anostomus* (=*Schizodon*) *knerii* Steindachner (1875, Sitz. Akad. Wiss. Wien, Math.-natur. Cl., vol. 71, p. 1 of separate, pl. 1), a species which Garman (loc. cit.) placed in synonymy with *Schizodon isognathus* Kner. Parenthetically, the fish described and figured from Descalvados by Fowler (1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, pp. 345-346) as "*Lahilliella nasuta*" is grossly misidentified. It has the color but not the scale count of *Nanognathus borellii* Boulenger (see reference in generic synonymy), a fish which may belong either with the anostomines or with *Nannostomus* or *Characidium*. The fish which Eigenmann, McAtee and Ward (1907, Ann. Carnegie Mus., vol. 4, p. 124, pl. 39, fig. 2; Asuncion, Paraguay) call *borelli* has nothing to do with Boulenger's fish. I have examined Paraguayan specimens and the fish is close to or identical with one of the Amazonian forms generally referred to *Schizodon fasciatus*.

I have seen material that has been referred to most of the specific names in the genus, including *S. orinocensis* (Steindachner) 1879 (Denks. Akad. Wiss. Wien, Math.-natur. Cl., vol. 41, p. 154, pl. 2, fig. 7), but I am certain of the identification of almost none of it. So far as I know, the following specific names belong to this group: *S. fasciatus* Agassiz, *S. f. corti* Schultz, *S. vittatus* (Cuv. and Val.), which is figured from the type by Castelnau, *S. isognathus* Kner, *S. knerii* (Steindachner), *S. dissimilis* (Garman), *S. platae* (Garman), *S. nasutus* Kner, *S. rostratus* (Borodin), and *S. orinocensis* (Steindachner).

Genus *LAEMOLYTA* Cope

Laemolyta Cope 1872, Proc. Acad. Nat. Sci. Philadelphia, 1872, p. 258 (type by monotypy *Schizodon taeniatus* Kner).

Schizodontopsis Garman 1890, Bull. Essex Inst., vol. 22, pp. 15, 16 (type *Schizodon taeniatus* Kner, by subsequent designation of Eigenmann 1910, Reports Princeton Univ. Expeds. Patagonia, Zool., vol. 3, pt. 4, p. 425).

In this genus the mouth is turned slightly upward and the lower teeth, at least, are flattened, truncated incisors. Often the upper ones are much the same. There has been uncertainty in regard to *Laemolyta*, due to Cope's statement that the gill-membranes of *Schizodon taeniatus* are connected with each other but free from the isthmus. If my material of that species (Pebas, Peru; Scherer coll.) is correctly identified, as I believe it to be, Cope was in error. The gill-membranes are narrowly but firmly united with the isthmus. It may be recalled that other material from Cope's upper Amazon collection was misinterpreted by him (see Gosline, this Bulletin, vol. 2, p. 1), due to its poor condition when it reached him.

This genus is distinguished from *Schizodon* principally by the flat, apical truncation of the lower teeth. After examining several species of *Laemolyta*, it seems to me that the species are very poorly defined and that identification of material, and descriptions of new forms, should be done with the greatest circumspection. The following table has been compiled from Garman (see reference in generic synonymy), from Borodin (1931, Bull. Mus. Comp. Zool. Harvard, vol. 72, no. 2), and from Steindachner (1879, Denks. Akad. Wiss. Wien, Math.-natur. Cl., vol. 41, p. 154, pl. 2, fig. 7). It indicates the characters used by those authors rather than those obser-

ved in my own material. In giving the transverse scale count, the "one-half" scale (a narrow, not fully developed scale often present at dorsal and ventral origins) is overlooked.

L. taeniata (Kner). Depth 4.75. Head 4.75. Scales 5/43-44/4. D. 11. A. 10. V. 10. A dark, midside, lateral stripe. Type locality: Rio Guaporé.

L. proxima (Garman). Depth 4.5. Head 4.5. Scales 6/45/5(6). D. 12-13. A. 10-11. A dark, midside, lateral stripe. Type locality (restricted): Villa Bella.

L. varia (Garman). Depth 4.33 (less than 4 in older examples). Head 4.33. Scales 6/45-48/5(6). D. 12-13. A. 11-12. Indistinct dark, midside, lateral stripe; indistinct transverse bands. Type locality (restricted): Lagoa Hyanuary.

L. nitens (Garman). Depth 5. Head 5.5. Scales 6/45-47/6(7). D. 12. A. 11. V. 9. Dark lateral stripe pale or absent; transverse bands reduced to midside blotches; narrow dark lines across dorsum. Type locality: Içá.

L. garmani (Borodin). Depth 4.7. Head 4.7. Scales 4/42-43/4. D. 12. A. 10. V. 9. A black (permanent in alcohol), midside, lateral stripe. Type locality: Lagoa Saraca.

L. orinocensis (Steindachner). Depth 4. Head 4.0-4.66. Scales 7-8/44-48/6. D. 12. A. 10. V. 9. A dark, midside, lateral stripe. Type locality: Angostura (Ciudad Bolivar).

L. laticeps (Eigenmann) 1912 (Mem. Carnegie Mus., vol. 5, p. 298, pl. 41, fig. 4; type locality Crab Falls, British Guiana). Depth 3.0-3.16 (4 in young). Head 4.2. Scales 6/42/4-5. Obscure dark cross-bands, a narrow one above middle of pectoral fin, a broad one between dorsal and pelvics, and a broad one just before adipose and above anal origin. Caudal base dark. The young example, with depth 4, from the lowlands at Gluck Island, is too slender and may not be the same species.

L. fasciata Pearson (1924, Indiana Univ. Studies, vol. 11, no. 64, p. 29, pl. 10, fig. 1; type locality Lake Rogoagua, Bolivia; name preoccupied in *Schizodon* but not in *Laemolyta* and therefore valid; see *Anostomus pearsoni* Ahl, Sitzb. Ges. Naturf. Freunde, Berlin, Nov. 1937). Depth 3.5-3.65. Head 3.0-3.1. L.l. 36, l.tr. 9. D. 12. A. 12-13. Broad, transverse, dark bands. Based on 2 young examples, 20 mm. long.

Most of the above are slender species with a lateral dark band. Of this kind of fish I have seen several examples from the upper Orinoco and some from Pebas, Peru. The latter seem without much doubt to be *L. taeniata*. The dorsal positions and fin counts in the forms appear to be so close as to be meaningless, and the other fin positions seem to be very much the same throughout. One large example (SU 22071, from Belém do Pará) is more robust than the others. It has the depth 3.9 in standard length and the scales 6/42/5. The example is very pale but there are remnants of a dark, midside stripe and five broad, transverse bands, broader above and narrowing below. The first is above the pectoral, the second at dorsal origin, the third behind the dorsal, the fourth above the anal and the fifth at the tail-root. This is provisionally identified as *L. varia*. It was reported by Starks (1913, Fishes Stanford Exped. Brazil) as *Leporinus affinis*. The upper Orinoco examples, with the dark dorsum marked by light scale centers, seem to be *L. orinocensis*.

Laemolyta fernandezi, sp. n. One small example, standard length 72.5 mm. from the upper Orinoco (more exact locality doubtful, due to removal of the original label by someone working on these fishes), collected by Carl Ternetz, agrees with the majority of the species in the slender form (depth 4.4) and the dark lateral band, and with Garman's account of *L. varia* in the numerous, narrow, vertical lines crossing the dorsum. It differs from all in the much more compressed body (breadth of body at opercles 1.8 in

greatest depth) and in the greater transverse scale count, the numbers being 8/49/7. The adipose is blackish and the lateral band darkest at tail-root. The SU register number of the type is 16126. This species is named for Mr. Agustin Fernandez-Yepez.

[Genus *ANOSTOMOIDES* Pellegrin

Anostomoides Pellegrin 1908, Bull. Mus. Hist. Nat. Paris, 1908, no. 7, p. 346 (type by monotypy *A. atrianalis* Pellegrin).

This genus, based on *A. atrianalis* from the Orinoco, is insufficiently described to place in the above synopsis. The type has the upper jaw with 2 flattened bicuspid teeth in front (the symphysial pair), flanked on each side by several tricuspid teeth. In the lower jaw, the symphysial pair is enlarged, recurved, with the superior borders more or less rounded, the lateral teeth not denticulated. Eight teeth in each jaw. Mouth directed up. D. 13. A. 11. P. 16. V. 9. Scales 6/39-41/5. Depth 3. Head 3.5-3.75. More or less unicolor, the adipose and anal blackish. This may be close to *Synaptolaemus* or it may not, but it certainly is not the same species.]

SUMMARY

The genera of Anostominae (in the sense of Eigenmann 1912) are revised, compared, and defined for the first time. One new genus, *Synaptolaemus*, is described, as well as three new species *Synaptolaemus cingulatus*, *Leporinus brunneus*, and *Laemolyta fernandezi*, all from the upper Rio Orinoco-Rio Negro region.

A NEW NAME FOR *HANNO*, A GENUS OF AFRICAN GOBIES.— The generic name *Hanno* Herre (1946, Proc. Biol. Soc. Washington, vol. 59, p. 123) is preoccupied by *Hanno* Gray 1821, a mammal. The new name *Hannoichthys* is herewith proposed for my genus.—Albert W. Herre.

A NEW LUMP-SUCKER OF THE GENUS *EUMICROTREMUS* FROM THE NORTHWESTERN ATLANTIC

By George S. Myers and James Böhlke

While identifying some North Pacific lump-suckers, an examination of the Atlantic member of the genus *Eumicrotremus (E. spinosus)* was also made in order to evaluate previous opinions (Collett 1880, p. 49; Günther 1887, p. 66; Jordan and Gilbert 1883, p. 746; and others) that these two species may actually be conspecific. Along with the conviction that the two forms should remain distinct, an entirely unexpected situation presented itself, with reference to the Atlantic species.

The species *Eumicrotremus spinosus* (Müller) is represented in the Natural History Museum of Stanford University by two specimens from widely separated Atlantic localities, Greenland and Newfoundland. Until now, only a single form has been recognized in the North Atlantic (with the possible exception of *E. derjugini* Popov as recorded by Vladykov 1933, about which more will be said later), but our Atlantic specimens certainly appear to represent two distinct species. The Greenland specimen is taken to be topotypical of *E. spinosus* and is readily identifiable with the published descriptions of that species, while the Newfoundland example is considered to represent an undescribed form.

Eumicrotremus terrae-novae, new species

Eumicrotremus spinosus (nec Müller) Goode and Bean, 1895, fig. on p. 273.

Holotype.— Stanford No. 9559, dredged by the U. S. Fish Commission Steamer "Albatross" at Station 2445, 46°09'30" North Latitude, 49°48'30" West Longitude, off Newfoundland, at a depth of 39 fathoms, June 25, 1885. This specimen was acquired by exchange from the U.S. National Museum many years ago as *E. spinosus*.

Measurements of the holotype in millimeters.— Standard length 41, head 14.6, snout to anal opening 25, eye 5.9, interorbital 8.4, horizontal width of closed mouth 9.5, depth of body at first dorsal insertion 20.7, least depth of caudal peduncle 3.9, length of first dorsal base 9, length of second dorsal base 11, length of anal base 8.3, ventral disk length 11.5, ventral disk width 11.8, body width at gill opening 19.2.

Fin counts.— First dorsal 7, second dorsal 12, anal 11, caudal 6 + 5, pectoral 25.

Description.— Body short, compact, suborbicular, flattened slightly below. Head large, rounded on the sides, nearly triangular in cross-section through its posterior limits. Head and body, exclusive of axilla and pre-anal ventral surface, covered by tubercles with compound spines. Head and body (to anal opening) 1.6 in standard length. Head 2.8 in standard length. Eye 1.4 in interorbital, 2.5 in length of head.

Nostrils tubular; the anterior widely separated, on the snout; the posterior directly behind, on the interorbital space. Lateral line present, with pores that open externally through short raised tubes; those on top of the head consisting of: (a) a pair at the anterior inner border of the anterior nostrils, (b) a pair slightly indented between the anterior and posterior nostrils, and (c) a single median pore just to the rear of the posterior nostrils.

EUMICROTREMUS TERRAE-NOVAE

Lips wide, fleshy. Margin of upper lip entirely free, that of lower lip free at the sides but with a moderately developed frenum. A pair of tubular, barbel-like processes present on either side of the frenum. There are three or four more of these "barbels", more or less irregularly placed, on either side of the chin. Teeth on each jaw small, conical, in narrow villiform bands, separated medially by a fleshy space.

Sucking disk nearly round, its width very slightly greater than its length. Top of gill opening at level with top of eye, its length subequal to the orbital diameter. Origin of pectorals beneath the anterior margin of the ventral disk, the fins separated by a space equal to width of gill opening, subequal to eye diameter. Origin of first dorsal immediately above gill opening. The last ray of the first dorsal fin appears tubular, but this may be an abnormality. Distance between first and second dorsals less than length of first dorsal base. Second dorsal begins before anal origin.

Spiny tubercles unevenly scattered over head and body. Chin completely covered with very sharp, compound tubercles. Those on interorbital space irregularly disposed, in no definite series, but approximately six in a transverse line between the eyes. Bases of pectorals covered by tubercles. Three tubercles on either side at the base of the first dorsal fin; two on either side between the first and second dorsals; five or six smaller ones closely applied to the base of the second dorsal fin; five or six along the base of the anal fin. Thirteen or fourteen tubercles present around rim of eye. Interorbital region and snout thickly sprinkled with small spiny tubercles. Largest tubercle just posterior to the axilla.

Differences from related forms.— According to the several published accounts (Günther 1880, p. 484, fig. 219; Garman 1892, p. 34, pl. 11, figs. 1-3) of the young of *Eumicrotremus spinosus*, the number of tubercles, once they are developed, does not appear to decrease with age, especially in the particular regions of the body described in the preceding paragraph. Rather, the existing tubercles merely grow in size. The new species differs from *E. spinosus* mainly in the more numerous tubercles on all the above-mentioned parts of the body. The chin of this new species is covered with spiny tubercles, whereas it is covered by naked fleshy folds in *E. spinosus*. There appears to be much controversy about this character of tubercles on the chin. While it is possible that they may be either present or absent within a species, and when absent, replaced by fleshy folds, it is much more likely that the characterization of *E. spinosus* is very uncertain and has been much confused due to the alternate raising from and sinking into its synonymy of *E. orbis*. The Greenland specimen at Stanford shows no tubercles and Popov (1930, p. 71), in his review of the Cyclopteridae, characterizes *E. spinosus* as possessing no chin tubercles. Goode and Bean's text-figure (1912, p. 273) is a figure of *terrae-novae*; however, their figure 250, plate 70, is probably copied and is a figure of *spinosus*.

The tubercles on the head are generally more numerous on the new species than on *spinosus*; there are about six irregularly placed tubercles transversely between the eyes of *terrae-novae*, versus four, evenly arranged, on *spinosus*. There appear to be more tubercles along the bases of the fins of *E. terrae-novae* than along those of *spinosus*.

From *Eumicrotremus orbis* Günther the new species differs primarily in the position of the anal opening, the anus being much farther forward (closer to the sucking disk) on *orbis* than on either *terrae-novae* or *spinosus*.

When compared with descriptions of *Eumicrotremus derjugini* Popov, the new species stands as very distinct. *E. derjugini* has been recorded several times from the eastern coasts of Canada and from Hudson Bay, but the only author who attempts a description of the specimens recorded is Vladykov (1933, p. 34). From this description it is impossible to be certain

that Vladykov had Popov's species, since the following two very important characters (Popov 1928, p. 16) were omitted: "Small sucker far remote from anal aperture. Eyes, and space between them - small." *E. terrae-novae* is easily distinguished from *derjugini* in the possession of characters in opposition to the above two; and, in addition, in possessing bony tubercles on the chin, barbel-like tentacles on the chin, first dorsal fin free of thick skin, and tubercles on the pectoral fin base.

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ADDENDUM.—Unfortunately, we have discovered Jensen's paper on *Eumicrotremus* (1944, Spolia Zool. Mus. Hauniensis, vol. 4, pp. 48-57) just as our paper goes to press. This will require some revision of our results, but we believe *terrae-novae* to be different from *spinosus* and *variabilis*.

STATION RECORDS OF THE CROCKER-STANFORD DEEP-SEA EXPEDITION, COAST OF CALIFORNIA, SEPTEMBER 1938

Compiled by Rolf L. Bolin and George S. Myers

In 1938, the late Mr. Templeton Crocker of San Francisco invited the Stanford group of ichthyologists to utilize his yacht *Zaca* for a short cruise along the coast of California. The ship was already outfitted for deep-sea work, having been used for this purpose during two Central American cruises made by Mr. Crocker accompanied by Dr. William Beebe and Mr. John Tee-Van of the New York Zoological Society.

Besides Mr. Crocker, personnel included the late Captain Petersen, master of the *Zaca*; Professors G. S. Myers and R. L. Bolin, scientific leaders, the latter in direct charge of dredging and trawling; and Kenneth Stanton, William A. Gosline, Earl S. Herald, and Alexander Calhoun, student ichthyologists. It was intended to include Robert Rush Miller as one of the assistants, but he was unable to participate.

The expedition sailed from San Francisco Yacht Harbor on September 9, 1938, proceeded southward along the coast as far as the Mexican line and returned to San Francisco on September 25. The single large beam-trawl was wrecked on its first trial and most of the deep-water work was done with intermediate plankton nets and small dredges. Extensive collections of most groups of marine animals were made. Numerous deep-sea myctophids and some ceratioids were obtained, as well as *Vampyroteuthis*. The myctophids were reported in this Bulletin, vol. 1, no. 4, by Prof. Bolin, and the pycnogonids by Mr. Joel Hedgpeth in "The American Midland Naturalist", vol. 22, no. 2 (1939), and vol. 25, no. 2 (1941). Most of the rest of the material is still unworked, and is stored in the Natural History Museum, but a good many of the mollusks have recently been turned over to Dr. S. S. Berry of Redlands for study.

In the station records below, the data are given in the following order: (1) serial number, (2) location or position, usually with latitude and longitude (west of Greenwich), (3) date, (4) time of day, often indicating duration of haul, (5) depth of haul, sometimes given as length of wire out, (6) type of gear used, (7) character of bottom, taken from U.S. Hydrographic Office charts if no sample of bottom was secured, (8) a notation "on bottom" if the gear was hauled on the bottom, (9) other pertinent information, including weather, sea, and brief notes on catch.

STATION 1. Off Point Pinos, south end of Monterey Bay, drifting at night in fog; probably 1 to 2 miles off shore. Sept. 10, 10:45 - 12:00 P.M. Surface, at submerged electric light. Dipnets. Character of bottom not known. Heavy fog; smooth medium swell. Schizopods, amphipods, ctenophores, medusae. Lantern fishes, all taken in about 10 minutes, 11:00 to 11:10 P.M.

STATION 2. Off Point Sur. 36°14'30"N., 121°54'00"W. Sept. 11, 1:52 — 2:10 P.M. 60 fathoms. 4-foot dredge. Rock bottom. On bottom. Weather overcast, slight swell. Dredge frame bent on rocks, net almost empty. Sponges, ophiurians, hydroids, bryozoans, etc.

STATION 3. Off Point Sur. 36°14'15"N., 121°54'00"W. Sept. 11, 2:40 — 2:43 P.M. 60 fathoms. 4-foot dredge. Rock bottom. On bottom. Weather overcast, slight swell. Dredge frame bent, its net lost.

STATION 4. Off Point Buchon. 4.5 miles, 180° true from Point Buchon. 37°11'N., 120°54'W. Sept. 12, 7:00 - 8:00 A.M. Depth and bottom not determined. Hand lines, on bottom. Weather foggy, sea calm. Caught 5 species of Sebastodes.

STATION 5. Off Point San Luis, 6 miles, 248° true from Point San Luis Light. 35°08'N., 120°52'W. Sept. 12, 9:20 - 10:00 A.M. 56 fathoms. 12-foot beam trawl. Rock bottom. On bottom. Weather overcast, sea calm. Beam smashed, net badly torn. Corals, ophiurids, pycnogonids, bryozoans, etc., adhering to net.

STATION 6. San Luis Obispo Bay, 0.5 miles, 159° true from Point San Luis Light. 35°04'N., 120°43'W. Sept. 12, 11:18 - 11:30 A.M. 20 fathoms. 4-foot dredge. Bottom fine green mud. On bottom. Weather overcast, light northwesterly swell. Dredge frame slightly bent. Good catch.

STATION 7. Santa Barbara Channel, ½ mile, 180° true from derrick at San Augustine. 34°27'30"N., 120°19'00"W. Sept. 12, 6:00 P.M. until after dark. Surface, at electric light, and hand lines, on bottom. Sand bottom. Weather clear, sea calm. Sharks, Scorpaena, and mackerel on lines, octopods, young blennies, worms, and amphipods on eel grass under light.

STATION 8. Santa Barbara Channel. 34°27'45"N., 120°19'00"W. Sept. 12-13, 6:00 P.M. to 7:00 A.M. 5 fathoms. Gill-net, set along outside kelp bed; net set on bottom, reaching to about 2 fathoms from surface. Weather clear, sea calm. Caught 20 mackerel, 3 Sebastodes, 2 rubberlip, and other fishes.

STATION 9. Santa Barbara Channel. Set one 150-hook bottom line for fish, attached to large buoy. Gear disappeared completely, with buoy.

STATION 10. Santa Barbara Channel, 9 miles, 301° true from west point of Santa Cruz Island. 34°09'N., 120°04'W. Sept. 13, 11:30 A.M. to 1:30 P.M. Depth not recorded. 4-foot dredge. Bottom green mud. On bottom. Broken sky, moderate N.W. wind, sea choppy. Good catch of fishes and invertebrates.

STATION 11. Bechers Bay, Santa Rosa Id. 33°59'30"N., 120°02'15"W. Sept. 13, 4:00 - 6:00 P.M. Shore, sand beach. 120-foot beach seine. Broken sky, brisk N.W. wind, moderate surf. Jacksmelt, anchovies, and surfperch.

STATION 12. Bechers Bay, Santa Rosa Id. 33°59'20"N., 120°02'00"W. Sept. 13, 4:00 - 6:00 P.M. Shore, rocky tide-pools at S. end of bay. Derris root fish poison and dipnets. Various fishes and sea-stars, including one Pisaster ochraceus (not saved) that was 17 inches across, and another 16 inches.

STATION 13. Bechers Bay, Santa Rosa Id. 34°00'00"N., 120°02'00"W. Sept. 13, 4:00 - 9:00 P.M. Surface, under electric light, with dipnets; hand lines; spear. Depth of water and character of bottom not recorded. Several sharks and fishes on lines, including one Cephaloscyllium uter of 31 inches, Galeorhinus zyopterus, Pimelometopon, etc. Mola mola speared at surface.

STATION 14. S.E. of Santa Rosa Id., 22 miles, 140° true from Gull Id. at S.W. end of Santa Cruz Id. 9-mile haul from 33°47'N., 119°40'W., to 33°40'N., 119°32'W. Sept. 14, beginning at 8:57 A.M., second net out at 9:07 A.M., 1000 fathoms wire out at 9:36 A.M. Began to haul in at 12:36 P.M. Depth 790 fathoms plus. 4-foot plankton net (Net A), and 3-foot, 7-inch plankton net (Net B) rigged on same wire 100 fathoms up. Depth of water and character of bottom not known. Sky overcast, brisk N.W. wind, sea choppy. Myctophids, Melanostigma pammelas, Leuroglossus stilbius, Idiacanthus, Cyclothone, Argyropelecus, medusae, euphausiids, ctenophores, chaetognaths, Vampyroteuthis heathi, etc.

STATION 15. Bank north of Santa Barbara Id. 33°37'30"N., 119°08'W. Sept. 14, 4:30 - 5:10 P.M. 82 fathoms. 4-foot dredge. Bottom soft, brownish shale. On bottom. Sky overcast, brisk N.W. wind, sea choppy. Mainly sponges. Also spider crabs, munids, Strongylocentrotus fragilis, Ophiophilus, anthozoans, and annelids.

STATION 16. Bank north of Santa Barbara Id. 33°37'N., 119°05'W. Sept. 14, 5:18 - 6:00 P.M. 80 fathoms. 4-foot dredge. On bottom. Character

of bottom not recorded. Sky overcast, brisk N.W. wind, sea choppy. Icelinus tenuis, Xeneretmus, sea-urchins, mollusks, bryozoa.

STATION 17. Between Santa Cruz and Santa Rosa Ids. 33°35'N., 118°43'W. Sept. 14, 8:45 - 9:30 P.M. Surface, at electric light, with dipnets, over bottom at 300 fathoms. Character of bottom not known. Sea choppy, brisk N.W. wind. Cololabis and Loligo, latter not saved.

STATION 18. Avalon Harbor, Santa Catalina Id. 33°21'N., 118°19'20"W. Sept. 15, 10:00 A.M. to 1:00 P.M. Over bottom at 13 fathoms. Hand lines from ship. Medialuna, Pimelometopon, and other fishes.

STATION 19. Off Santa Catalina Id. 33°21'50"N., 118°16'30"W. Sept. 15, 3:20 - 3:40 P.M. 156 fathoms. 4-foot dredge. Character of bottom not recorded. On bottom. Weather clear, sea calm. Canvas dredge cover flapped over mouth of dredge. Sea-urchins, ophiurians, sponge fragments.

STATION 20. Isthmus Cove, Santa Catalina Id. 33°26'45"N., 118°29'30"W. Sept. 15, 7:00 - 10:00 P.M. Surface, at electric light, with dipnets; hand lines; from ship at anchor in 16 fathoms. Squalus on hand lines, with Hypsipops in stomach. At surface, Portunus, jacksmelt, copepods, annelids, latter luminescent.

STATION 21. Isthmus Cove, Santa Catalina Id. 33°26'50"N., 118°29'25"W. Sept. 15 - 16, 6:00 P.M. to 10:00 A.M. 5 fathoms to near surface. Gillnet, set overnight along kelp bed. Paralabrax, Medialuna, Pimelometopon.

STATION 22. South side of the Isthmus, Santa Catalina Id. 33°25'45"N., 118°30'18"W. Sept. 16, 6:35 - 7:30 A.M. Shore collecting. Dipnets and small seines. Sardines, jacksmelt, gobies, Girella.

STATION 23. Off Isthmus Cove, Santa Catalina Id. 33°27'25"N., 118°29'35"W. Sept. 16, 9:42 - 9:55 A.M. 4-foot dredge. On bottom. Character of bottom not recorded. Xantocles frenatus, Citharichthys sordidus, Icelinus quadriseriatus, large gastropods, sponges, tunicates, bryozoans.

STATION 24. Off Isthmus Cove, Santa Catalina Id. 33°27'40"N., 118°28'45"W. Sept. 16, 10:54 A.M. to 12:00 N. 4-foot dredge. Character of bottom not recorded. On bottom, dredging up a shelving shore.

STATION 25. Off Isthmus Cove, Santa Catalina Id. 33°28'N., 118°26'30"W. Sept. 16, 12:32 - 1:28 P.M. 107 - 130 fathoms. 4-foot dredge. Character of bottom not recorded. On bottom.

STATION 26. San Pedro Channel, between Santa Catalina Id. and the mainland. 6-mile haul, true N., from 33°30'N., 118°23'W., to 33°36'N., 118°23'W. Sept. 16, 2:10 to 5:40 P.M. Depth 500 fathoms, plus or minus; 700 fathoms wire out; net A calculated to be 296 fathoms deep. 4-foot plankton net (Net A), and 3-foot, 7-inch plankton net (Net B) rigged on same wire 100 fathoms up. Depth of water not known, bottom recorded as gray mud. Myctophids, Cyclothone, Bathylagus, Leuroglossus, medusae, schizopods, amphipods, copepods, chaetognaths, pteropods, etc.

STATION 27. San Pedro Channel, drifting. 33°36'N., 118°23'W. Sept. 16, 8:00 - 9:30 P.M. Surface, at electric light, over 529 fathoms water; dipnets. Cololabis and mackerel only.

STATION 28. San Pedro Channel, 8.5 miles, 198° true from Point Fermin. 33°35'N., 118°20'W. Sept. 17, 7:05 - 8:40 A.M. Same nets and net arrangement as at stations 14 and 26. Net A (deeper) over side at 7:05, net B at 7:13. 600 fathoms wire out at 7:32. Struck bottom and began to haul in at 8:05. Upper net (B) taken aboard at 8:35 filled with green mud and bottom animals. Lower net (A) torn off rim and lost. Either our position or depth recorded on chart erroneous. Stichopus (not saved), Lytechinus, Astropecten, Lindia, Pseudarchaster, Ophiura, scalpellid barnacles, amphypods, Heterocrypta, Mursia, crabs, gastropods, dentaliids.

STATION 29. Off Lone Point, Santa Catalina Id. From 33°27'N., 118°20'W., to 33°30'N., 118°23'W. Sept. 17, 10:02 A.M. to 1:45 P.M. Depth about 500 fathoms, 600 fathoms wire out. Depth and character of bottom not recorded. Light rain, cloudy, moderate swell.

STATION 30. Off Avalon, Santa Catalina Id., 33°23'N., 118°20'W. Sept. 17, 3:03 - 3:45 P.M. 80 fathoms. 4-foot dredge. Bottom dead and bleached corallines. On bottom. Spatangoids, fuzzy tunicates, crabs, mollusks, large tube-worm.

STATION 31. Off Avalon, Santa Catalina Id. 33°21'N., 118°18'W. Sept. 17, 4:05 - 4:40 P.M. 90 fathoms. 4-foot dredge. Bottom sea-urchins and dead, bleached corallines. On bottom. Spatangoids in abundance, with melanellids on them, Hippasterias, Pseudarchaster, Astropecten, yellow Henricia, Icelinus.

STATION 32. Avalon Harbor, Santa Catalina Id. 33°20'45"N., 118°19'15" W. Sept. 17, 8:00 - 10:00 P.M. Surface at electric light, with dipnets; hand lines on bottom; from ship at anchor in 15 fathoms. Character of bottom not recorded. Cloudy, calm; smooth water, slight swell. Cephaloscyllium, Scorpaena, mackerel on hand lines. Jacksmelt, Loligo, young fish at light, including many Cypselurus.

STATION 33. Off S.W. end of Santa Catalina Id. 33°17'N., 118°21'W. Sept. 18, 7:59 - 8:07 A.M. 45 fathoms. 4-foot dredge. Bottom green mud. On bottom. Calm, cloudy, water smooth, slight swell. Lytechinus, Megasercula, Odontopyxis, Porichthys.

STATION 34. Outer Santa Barbara Channel, between Santa Catalina and San Clemente Ids. 33°18'N., 118°26'W. Sept. 18, 8:47 - 9:19 A.M. 50 fathoms, 150 fathoms wire out. 4-foot dredge. Character of bottom not recorded. On bottom. Dredge net torn from frame at one corner. Large amount small seaweed rich in bryozoans, Lytechinus, annelids, crabs, Raja binoculata, R. montereyensis, Microstomus pacificus.

STATION 35. Outer Santa Barbara Channel, between Santa Catalina and San Clemente Ids. 6-mile haul, from 33°15'N., 118°24'W., to 33°07'N., 118°19'W. Sept. 18, 10:02 A.M. to 2:35 P.M. Depth calculated as 500 to 529 fathoms; 800 fathoms wire out. 3-foot, 7-inch plankton net. Depth and character of bottom at this place not recorded. Weather sunny, hazy, no breeze; sea calm, medium swell. Dolopichthys acanthias, brotulid, lantern fishes, Cyclothone, Sternoptix, Maurolicus, Stomias, Bathylagus, Leuroglossus, medusae, pteropods, copepods, worms, salps.

STATION 36. Avalon Harbor, Santa Catalina Id. 33°20'45"N., 118°19'15"W. Sept. 18, 8:00 - 9:00 P.M. Surface at electric light, dipnets: from ship at anchor in 15 fathoms. Character of bottom not recorded. Luminescent greenish annelids, young Medialuna, portunid crab, jacksmelt, mackerel.

STATION 37. Off Santa Catalina Id., drifting, 8 miles 212° true from S. E. Rock. 33°12'N., 118°23'W. Sept. 18, 10:00 - 11:00 P.M. Surface at electric light, with dipnets. Depth and character of bottom not known. Clear, sea choppy, medium swell. Cololabis, lantern fishes, young flying fish, young percoid.

STATION 38. Cortez Bank. 32°28'N., 119°08'W. Sept. 19, 8:00 - 8:22 A.M. 42 fathoms. 4-foot dredge. Bottom dead shell. On bottom. Clear, sunny, N.W. breeze, somewhat choppy, medium swell. Lovenia, Lytechinus, clam, Astropecten.

STATION 39. Cortez Bank. 32°29'N., 119°09'W. Sept. 19, 8:27 - 8:34 A.M. 58 fathoms. 4-foot dredge. Bottom dead shell. On bottom. Weather clear, N.W. breeze, choppy, medium swell.

STATION 40. Cortez Bank. 32°30'N., 119°10'W. Sept. 19, 9:04 - 9:46 A.M. 60 fathoms. 4-foot dredge. Bottom of shell and pebble, with limy concretion on all. On bottom. Weather as before.

STATION 41. Cortez Bank. 32°31'N., 119°15'W. Sept. 19, 10:46 A.M.; on bottom at 10:53, hooked on obstruction at once and hauled up immediately; aboard at 11:00. 48 fathoms. 4-foot dredge. Bottom rocks. On bottom. Weather as before. Brought up small piece of rock with coralline algae on it.

STATION 42. Cortez Bank. 32°30'N., 119°17'W. Sept. 19, 11:10 - 11:29

A.M. 50 fathoms. 4-foot dredge. Bottom rock, sandstone, with calcareous concretion. On bottom. Brisk N.W. wind, slight chop. Sponges, hydroids, bryozoans, tunicates, a few mollusks, annelids, and corals. Dredge frame bent. Brought up large rock of about 50 lb. bored by pholadids.

STATION 43. Cortez Bank. 32°34'N., 119°16'W. Sept. 19, 12:20 - 12:40 P.M. 50 fathoms. 4-foot dredge. Bottom rock. On bottom. Weather as before. Small rock fragments with sponge, hydroids, bryozoans, tunicates.

STATION 44. Tanner Bank. 32°40'N., 119°12'W. Sept. 19, 2:01 - 2:45 P.M. 130 fathoms. 4-foot dredge. Character of bottom not recorded. On bottom. Weather as before. Strongylocentrotus fragilis, spider crabs, hermit crab, shrimp, Lyopsetta exilis, last not saved.

STATION 45. Southwest of San Nicholas Id. Haul from 32°49'N., 119°57' W., to 32°56'N., 118°51'W. Sept. 19, 4:10 - 9:13 P.M. 800 fathoms wire out. 3-foot, 7-inch plankton net. Character and depth of bottom not recorded. Brisk N.W. wind, later dying out, slight chop. Melamphaes, Dolopichthys acanthias, Bathylagus, Lampanyctus, Leuroglossus stilbius, Cyclothone, Sternoptix, Idiacanthus, flatfish larvae, Melanostigma pammelas, squid, medusae, chaetognaths, euphausiids, etc.

STATION 46. Avalon Harbor, Santa Catalina Id. 33°20'45"N., 118°19'15" W. Sept. 20, 8:00 A.M. to 3:00 P.M. Hand lines from ship at anchor in 15 fathoms, and collecting on kelp hold-fasts pulled up from bottom. Brisk, variable winds, moderate swell. On lines, Gymnothorax, jacksmelt, Medialuna. Many bryozoans, shells, hydroids, and crustaceans from kelp hold-fasts.

STATION 47. Off Santa Catalina Id., 1 3/4 mile, 105° true from Lone Point. 33°22'N., 118°20'W. Sept. 20, 3:53 - 4:25 P.M. 60 fathoms. 4-foot dredge. Character of bottom not recorded. On bottom. Strong N.W. wind; whitecaps. Raja, Porichthys, Lyposetta, brachiopods, etc., etc.

STATION 48. San Pedro Channel, 19 miles, 260° true from Point Vincente. 33°41'N., 118°46'W. Sept. 20, 9:00 - 9:50 P.M. Surface at electric light; dipnets. Depth and character of bottom not recorded. Strong N.W. wind; very choppy. Myctophum, Tarletonbeania, Cololabis, etc.

STATION 49. Santa Barbara Channel. 34°24'N., 120°05'W. Sept. 21, 11:42 A.M. to 12:02 P.M. 85 fathoms. 4-foot dredge. Bottom green mud. On bottom. Moderate N.W. breeze; sunny; moderate swell. Porichthys, Lyopsetta, sea-urchins, Stichopus, etc.

STATION 50. Santa Barbara Channel. 34°24'N., 120°14'W. Sept. 21, 1:38 - 2:08 P.M. 130 fathoms. 4-foot dredge. Bottom green mud. On bottom. Moderate N.W. wind; moderate swell; sunny. Lyopsetta, agonids, Cucumaria, crabs, gastropods.

STATION 51. Santa Barbara Channel. 34°25'N., 120°18'W. Sept. 21, 2:42 - 3:12 P.M. 85 fathoms. 4-foot dredge. Bottom shale. On bottom. Moderate N.W. wind; moderate swell; sun. Dredge frame bent almost double. Cucumaria, Stichopus, gastropods.

STATION 52. Santa Barbara Channel. 34°26'N., 120°18'W. Sept. 21, 3:46 - 4:06 P.M. 20 fathoms. 4-foot dredge. Character of bottom not recorded. On bottom. Sunny; moderate northerly wind; choppy sea. Brought up large dead kelp hold-fast crawling with Ophiothrix spiculata and other organisms.

STATION 53. At anchor off San Augustine. 34°27'30"N., 120°19'00"W. Sept. 21, 8:00 - 9:30 P.M. Surface at electric light from ship at anchor in 13 fathoms; dip-nets. One blenny, 2 jacksmelt.

STATION 54. Off San Augustine. 34°27'45"N., 120°19'30"W. Sept. 21-22, 6:00 P.M. to 7:00 A.M. Gill-net, set from bottom almost to surface in 5 fathoms at edge of kelp bed. Strong to light northerly winds. Caught about 50 Genyonemus lineatus, 1 Seriphus politus, 1 Sebastodes, and some embiotocids.

STATION 55. Santa Barbara Channel, 3½ miles, 180° true from Tauguas. 34°25'N., 120°06'W. Sept. 22, 9:34 - 10:04 A.M. 45 fathoms. 4-foot dredge.

Bottom green mud. On bottom. Sunny; light N.W. breeze; moderate swell. Catch mainly Lytechinus and nuculid mollusks. Also Raja, Icelinus, Lyopsetta, dentaliids, scalpellid barnacles, Luidia, Turritella, etc.

STATION 56. Santa Barbara Channel, 3 miles, 180° true from Capitan. 34°25'N., 120°01'W. Sept. 22, 10:22 - 10:52 A.M. 40 fathoms. 4-foot dredge. Bottom green mud. On bottom. Light N.W. breeze; light swell; sun. Large dentaliids, Aphrodite, Astropecten, Pectinaria, holothurians, etc.

STATION 57. About 1 mile west of Santa Barbara Breakwater. 34°24'N., 119°42'30"W. Sept. 22, 3:00 - 3:45 P.M. Shore collecting with dipnets, around shelving shale outcrops projecting through sand, exposed to wave action and forming no permanent tide-pools. Water full of detritus; large loose pieces of kelp floating and littering beach. Cottid, Gibbonsia, Hypsoblennius.

STATION 58. Off Carmel. 8-mile haul, from 36°32'N., 122°13'45"W., to 36°38'15"N., 122°07'30"W. Sept. 24, 5:54 - 11:05 A.M. 1000 fathoms wire out. 3-foot, 7-inch plankton net. Broken sky; light N.W. breeze; calm. Chauliodus macouni, Lampanyctus leucopsarus, L. ritteri, Tarletonbeania crenularis, Cyclothone, Diaphus, Bathylagus, Melamphaes.